

Calendar Year 2001

Annual Site Environmental Report Tonopah Test Range, Nevada



Photograph of TTR courtesy of [unintelligible]

This report was prepared for the Nevada Test and Training Range.

Prepared by

Environmental Sciences Division

Los Alamos National Laboratory, Los Alamos, New Mexico 87545

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Environmental Sciences Division
Los Alamos National Laboratory

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Annual Site
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Tonopah Test Range, Nevada**

Project Lead
Francine Vigil

Associate Chief Editor, Graphics, and Document Specialist
Rebecca Sanchez

Technical Writer
Katrina Wagner

Reference Librarian
Lucie Mayeux

Produced by:
Sandia National Laboratories
P.O. Box 5800
Albuquerque, New Mexico 87185-0854

ABSTRACT

Tonopah Test Range (TTR) in Nevada is a government-owned, contractor-operated facility operated by Sandia Corporation, a subsidiary of Lockheed Martin Corporation. The U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) through the Office of Kirtland Site Operations (OKSO), Albuquerque Operations Office (AL), oversees TTR's operations. Sandia Corporation conducts operations at TTR in support of DOE/NNSA's Weapons Ordnance Program and has operated the site since 1957. Westinghouse Government Services subcontracts to Sandia Corporation in administering most of the environmental programs at the site. This Annual Site Environmental Report (ASER) summarizes data and the compliance status of the environmental protection and monitoring program at TTR through December 31, 2001. The compliance status of environmental regulations applicable at the site include state and federal regulations governing air emissions, wastewater effluent, waste management, and Environmental Restoration (ER) cleanup activities. Terrestrial surveillance for radiological and non-radiological contaminants is also conducted, as required by DOE, to determine contaminant levels at community, perimeter, and on-site locations. Sandia Corporation is responsible only for those environmental program activities related to its operations. The DOE/NNSA, Nevada (NV) office retains responsibility for the cleanup and management of ER TTR sites. Environmental monitoring and surveillance programs are required by DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990) and DOE Order 231.1, *Environment, Safety, and Health Reporting* (DOE 1996a).

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Prepared by:

Sandia Corporation, Albuquerque, New Mexico
Integrated Safety and Security Center
Environmental Management Department (3121)

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*Brenda Bailey-White
Linda Bayliss
Joe Bonaguidi
Kevin Cabble
Michael du Mond
Charles Fink*

*William Forston
Joe Guerrero
Joan Harris
Heidi Herrera
Adrian Jones*

*Hans Oldewage
Jennifer Payne
Stephanie Salinas
Rebecca Sanchez
Katrina Wagner*

NOTE TO THE READER

If you have comments or questions about this report,
or need further information, please contact:

Kenneth E. Zamora
Associate Director for Laboratory Operations
U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Mail Stop 0184
Albuquerque, NM 87185-5400

Office: (505) 845-6869
Fax: (505) 845-4710



ACRONYMS AND ABBREVIATIONS	iii
EXECUTIVE SUMMARY	S-1
1.0 INTRODUCTION (<i>Chapter Summary</i>)	1-1
1.1 TTR History and Operations	1-2
1.2 Site Description and Demographics	1-4
1.3 Regional Geology, Hydrology, Climate, and Fauna	1-4
1.4 Clean Slate and Double Tracks Sites	1-6
2.0 COMPLIANCE SUMMARY (<i>Chapter Summary</i>)	2-1
2.1 Compliance Status with Federal Regulations	2-2
2.1.1 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	2-2
2.1.2 Emergency Planning and Community Right-to-Know Act (EPCRA)	2-2
2.1.3 Resource Conservation and Recovery Act (RCRA)	2-2
2.1.4 Federal Facility Compliance Act (FFCA)	2-4
2.1.5 Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990	2-5
2.1.6 Clean Water Act (CWA)	2-5
2.1.7 Safe Drinking Water Act (SDWA)	2-5
2.1.8 Toxic Substances Control Act (TSCA)	2-5
2.1.9 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	2-5
2.1.10 National Environmental Policy Act (NEPA)	2-5
2.1.11 Endangered Species Act (ESA)	2-6
2.1.12 Migratory Bird Treaty Act (MBTA)	2-6
2.1.13 Cultural Resources Acts	2-6
2.1.14 Environmental Compliance Executive Orders (EOs)	2-6
2.2 2001 Audits	2-8
2.3 2001 Issues and Actions for TTR	2-8
2.4 Environmental Permits	2-8
2.5 Occurrence Reporting	2-8
3.0 ENVIRONMENTAL PROGRAMS INFORMATION (<i>Chapter Summary</i>)	3-1
3.1 ER Project Activities	3-2
3.2 Waste Management Programs	3-2
3.3 Spill Prevention Control and Countermeasures (SPCC) Plan	3-6
3.4 National Environmental Policy Act (NEPA) Program	3-6
3.5 Environmental Monitoring Performed by Outside Agencies	3-6
3.6 Summary of Release Reporting	3-8
4.0 ENVIRONMENTAL MONITORING (<i>Chapter Summary</i>)	4-1
4.1 Terrestrial Surveillance	4-2
4.1.1 Program Objectives	4-2
4.1.2 Regulatory Standards and Comparisons	4-2
4.1.3 Statistical Analyses	4-2
4.1.4 Sampling Locations	4-2
4.1.5 Radiological Parameters and Results	4-3
4.1.6 Non-Radiological Parameters and Results	4-6

4.2	Water Monitoring	4-6
4.2.1	Production Well Monitoring	4-6
4.2.2	Sewage System and Septic Tank Monitoring	4-7
4.2.3	Storm Water Monitoring	4-8
4.3	Radiological Air Monitoring	4-8
4.4	Non-Radiological Air Emissions	4-9
5.0	REFERENCES	5-1
APPENDIX A State of Nevada Environmental Regulations		
APPENDIX B Terrestrial Surveillance Results and Sampling Location Maps		

FIGURES

1-1	Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada	1-3
1-2	Location of Facilities Operated by SNL/NV at TTR	1-6
4-1	Tonopah Test Range TLD Exposure (1997-2001)	4-7

TABLES

1-1	Project Roller Coaster Test Information	1-7
2-1	2001 SARA Title III (or EPCRA) Reporting Requirements Applicable to TTR	2-4
2-2	Protected Species Potentially Occurring in Nye County, Nevada.	2-7
2-3	Summary of Environmental Audits Performed at TTR in 2001	2-9
2-4	Summary of Permit Ownership at TTR	2-9
3-1	DOE/NNSA/NV ER Project TTR CAUs and CASs Calendar Year 2001 Status	3-3
3-2	Sandia Corporation TTR Generated RCRA-Regulated Hazardous Waste Shipped Off-site in 2001	3-7
3-3	Non-RCRA-Regulated Hazardous or Toxic Waste Shipped Off-site in 2001	3-7
3-4	Recycled Regulated Hazardous or Toxic Waste Shipped Off-site in 2001.	3-8
4-1	Decision Matrix for Determining Priority Action Levels	4-3
4-2	On-site Terrestrial Surveillance Locations at TTR	4-4
4-3	Off-site Terrestrial Surveillance Locations at TTR	4-4
4-4	Perimeter Terrestrial Surveillance Locations at TTR	4-5
4-5	Summary Statistics for Soil Locations Noted as Priority-2 for Am-241	4-6
4-6	Summary of TLD Measurements for 1997 to 2001	4-6
4-7	Calculated Dose Assessment Results for On-site Receptor	4-9

ACRONYMS AND ABBREVIATIONS

A	ACM	asbestos-containing equipment
	AEC	U.S. Atomic Energy Commission
	AIRFA	American Indian Religious Freedom Act
	AL	Albuquerque Operations Office
	ARPA	Archaeological Resources Protection Act
	ASER	Annual Site Environmental Report
	AST	aboveground storage tank
B	BLM	U.S. Bureau of Land Management
	BSA	Bulk Storage Areas
C	CAA	Clean Air Act
	CAAA	Clean Air Act Amendments
	CAS	Corrective Action Site
	CAU	Corrective Action Unit
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFR	Code of Federal Regulations
	COD	chemical oxygen demand
	CWA	Clean Water Act
	CY	calendar year
D	DMR	Discharge Monitoring Report
	DoD	U.S. Department of Defense
	DOE	U.S. Department of Energy
	DRI	Desert Research Institute, Water Resource Center, University of Nevada System
	DU	depleted uranium
E	EA	environmental assessment
	EDE	effective dose equivalent
	EO	Executive Order
	EIS	Environmental Impact Statement
	EM	Environmental Management (Department)
	EPA	U.S. Environmental Protection Agency
	EPCRA	Emergency Planning and Community Right-to-Know Act
	ER	Environmental Restoration
	ES&H	Environment, Safety, and Health
F	ESA	Endangered Species Act
	FFCA	Federal Facilities Compliance Act
	FFACO	Federal Facilities Agreement and Consent Order
	FIDLER	field instrument for the detection of low-energy radiation
	FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
H	FY	fiscal year
	HQ	headquarters
I	ICP-20	Inductively Coupled Plasma-20 (stable metals)
L	LDR	Land Disposal Restriction
	LLW	low-level waste
M	MBTA	Migratory Bird Treaty Act
	MDA	minimum detectable activity
	MOA	Memorandum of Agreement

	MEI	maximally exposed individual
	MSDS	Material Safety Data Sheet
	MW	mixed waste
N	NA	not applicable or not available
	NAEG	Nevada Applied Ecology Group
	NAFB	Nellis Air Force Base (Range Complex)
	NEDS	Non Explosive Destruction Site
	NDEP	Nevada Department of Environmental Protection
	NEPA	National Environmental Policy Act
	NESHAP	National Emission Standards for Hazardous Air Pollutants
	NHPA	National Historic Preservation Act
	NNSA	National Nuclear Security Administration
	NOS	not otherwise specified
	NPDES	National Pollutant Discharge Elimination System
	NPL	National Priorities List
	NTS	Nevada Test Site
	NTTR	Nevada Test and Training Range
	NV	Nevada
O	O&M	Operations and Maintenance
	OKSO	Office of Kirtland Site Operations
	OSHA	Occupational Safety and Health Administration
P	PA	Preliminary Assessment
	PCB	polychlorinated biphenyl
	PMS	portable monitoring station
	PPE	personal protective equipment
Q	QA	quality assurance
R	R&D	research and development
	RCRA	Resource Conservation and Recovery Act
	ROD	Record of Decision
	RQ	Reportable Quantity
	RY	reporting year
S	SARA	Superfund Amendments and Reauthorization Act
	SDWA	Safe Drinking Water Act
	SHPO	State Historic Preservation Office
	SNL/NM	Sandia National Laboratories, New Mexico
	SPCC	Spill Prevention, Control, and Countermeasures
	SVOC	semi-volatile organic compound
T	TLD	thermoluminescent dosimeter
	TPH	total petroleum hydrocarbon
	TQ	threshold quantity
	TRPH	total recoverable petroleum hydrocarbon
	TRI	Toxic Release Inventory
	TSCA	Toxic Substances Control Act
	TSD	treatment, storage, and disposal (facility)
	TTR	Tonopah Test Range
U	UDP	underground discharge point
	USAF	U.S. Air Force
	USFS	U.S. Forest Service
	USGS	U.S. Geological Survey

	UST	underground storage tank
	UXO	unexploded ordnance
V	VOC	volatile organic compound

Units of Measure

°C	Celsius degree	m	meter
cm	centimeter	m ²	square meter
°F	Fahrenheit degree	mg	milligram
ft	feet	mi	mile
g	gram	ppm	parts per million
in.	inch	yr	year
km	kilometer	kg	kilogram

Radioactivity Measurements

Ci	curie (unit of radioactivity)	pCi/g	picocurie per gram
mrem	millirem (unit of radiation dose)	rem	roentgen equivalent man (unit of radiation dose)
mrem/yr	millirem per year		
mR/yr	milliroentgen per year	mSv	millisievert (unit of radiation dose)
pCi	picocurie		

Chemical Abbreviations

Am-241	americium-241	Cs-137	cesium-137
Pu-238	plutonium-238	Pu-239	plutonium-239
Pu-240	plutonium-240	U _{tot}	uranium, total

Approximate Conversion Factors for Selected SI (Metric) Units

Multiply SI (metric) unit	by	To obtain U.S. customary unit
Celsius (°C)	°F = 9/5 °C + 32	Fahrenheit (°F)
centimeter (cm)	0.39	inch (in.)
cubic meter (m ³)	35	cubic feet (ft ³)
gram (g)	0.035	ounce (oz)
hectare (ha)	2.5	acre
kilogram (kg)	2.2	pound (lb)
kilometer (km)	0.62	mile (mi)
liter (L)	0.26	gallon (gal)
meter (m)	3.3	feet (ft)
milligram per liter (mg/L)	1	parts per million (ppm)
microgram per gram (mg/g)	1	parts per million (ppm)
square kilometer (km ²)	0.39	square mile (mi ²)

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Executive Summary

In this Chapter ...

<i>Environmental Programs</i>	<i>E-1</i>
<i>Waste Management</i>	<i>E-1</i>
<i>ER Project</i>	<i>E-1</i>
<i>Terrestrial Surveillance</i>	<i>E-1</i>
<i>Water Quality</i>	<i>E-2</i>
<i>Air Quality</i>	<i>E-2</i>
<i>NEPA Activities</i>	<i>E-2</i>

The U. S. Department of Energy (DOE) oversees Sandia Corporation's Tonopah Test Range (TTR) operations through the DOE, National Nuclear Security Administration (NNSA), Office of Kirtland Site Operations (OKSO), which reports to the Albuquerque Operations Office (AL). This report was prepared in accordance with, and as required, by DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990) and DOE Order 231.1, *Environment, Safety, and Health Reporting* (DOE 1996a). This report summarizes data from environmental protection and monitoring programs at the TTR through December 31, 2001. It also discusses Sandia Corporation's compliance with environmental statutes, regulations, and permit provisions and highlights other significant environmental programs and efforts at TTR. This report is a key component of Sandia Corporation and DOE's effort to keep the public informed about environmental conditions throughout the DOE/NNSA complex.

Sandia Corporation conducts operations at TTR in support of the DOE/NNSA's Weapons Ordnance Program. Sandia Corporation's activities involve research and development (R&D) and testing of weapon components and delivery systems. Many of these activities require a remote test range with a long flight corridor for air drops and rocket launches. Other activities include explosive tests and gun firings.

Environmental Programs

The following environmental programs are in place at TTR:

- Waste management,
- Terrestrial surveillance,
- Water quality monitoring,
- Air quality compliance (AQC),
- Environmental Restoration (ER), and
- National Environmental Policy Act (NEPA).

All program activities are performed on a Calendar Year (CY) 2001 basis, unless otherwise noted.

Waste Management

Waste generated at TTR in 2001 included hazardous waste regulated by the Resource Conservation and Recovery Act (RCRA) and non-hazardous industrial and sanitary waste. The following categories of waste were generated and handled by TTR in 2001:

<u>Waste Type</u>	<u>Weight</u>
RCRA waste	1,304 kg
Non-hazardous or recycled chemical waste	8,107 kg
Radioactive waste - exit signs for recycle (Tritium)	83 kg

All hazardous waste was shipped to permitted treatment, storage, and disposal (TSD) facilities. (Sandia Corporation does not handle waste generated by ER activities.)

ER Project

ER activities at TTR are conducted through the DOE/NNSA, Nevada (NV) office. ER sites at TTR include areas contaminated from past rocket firings and target tests, abandoned septic systems, solvent contaminated soils at previous underground storage tank (UST) areas, and disposal areas for ordnance, septic sludge, and depleted uranium (DU).

In 2001, there was no low-level waste (LLW) generated by the ER Project. ER cleanup activities generated a total of 95 kg of RCRA regulated hazardous waste. Another 43,116 kg of non-RCRA regulated hazardous waste was generated by the cleanup of sites with hydrocarbon-impacted soils and debris.

Terrestrial Surveillance

Soil samples were collected from 14 off-site, eight perimeter, and 21 on-site locations in 2001. Soil is the only terrestrial medium sampled at TTR. Samples are collected to detect air-deposited pollutants or contaminants that may have transported and deposited as a result of surface

water runoff. Thermoluminescent dosimeter (TLD) results (a measure of ambient gamma radiation) showed no distinguishable statistical difference between on-site and off-site locations in 2001. Non-radiological soil analyses were not performed in 2001 (analyses are scheduled for 2002).

Water Quality

Wastewater monitoring results confirmed that all permit conditions set by the State of Nevada were met in 2001.

Water quality samples are routinely taken from Production Well 6, which supplies potable water for Sandia Corporation's Main Compound at TTR. The U.S. Environmental Protection Agency (EPA) also performs sampling on Production Well 6 every three years. Water Quality sample results showed that all permit conditions were met in 2001.

Air Quality

Radiological air emissions are regulated by National Emission Standards for Hazardous Air Pollutants (NESHAP). The only radionuclide sources at TTR are the three Clean Slate Sites, which are sources of diffuse radionuclide emissions as a result of the re-suspension of contaminated soils. These sites

are currently being addressed by DOE/NNSA/NV under the ER Project. Continuous monitoring was conducted from February 22, 1996 to February 25, 1997 at the TTR airport, the area determined to be the site of the maximally exposed individual (MEI) (SNL 1997). The calculated dose was 0.024 millirem/year (mrem/yr), which is approximately 400 times less than the 10 mrem/yr standard set by the U.S. EPA. Based on this value, an annual dose assessment is not required to be calculated for the TTR site.

TTR's Class II Air Quality Permit requires emission reports from non-radionuclide sources. At TTR these sources include generators, paint booths, and various combustion sources. In 2001, the total emissions reported to the State of Nevada were 0.001 tons/yr from the screening plant.

NEPA Activities

At TTR, NEPA compliance is coordinated between Sandia Corporation and DOE/NNSA/OKSO. Compliance is also supported with the assistance of the Desert Research Institute (DRI), a branch of the University of Nevada System. A total of five NEPA Checklists were submitted to DOE/NNSA/OKSO for proposed actions in 2001.

Chapter 1

Introduction

In this Chapter ...

<i>TTR History and Operations</i>	<i>1-2</i>
<i>Site Description and Demographics</i>	<i>1-4</i>
<i>Regional Geology, Hydrology, Climate, and Fauna</i>	<i>1-4</i>
<i>Clean Slate and Double Track Sites</i>	<i>1-6</i>

Chapter Summary

Sandia Corporation (a subsidiary of Lockheed Martin Corporation through its contract with the U.S. Department of Energy [DOE]), National Nuclear Security Administration (NNSA) operates the Tonopah Test Range (TTR) in Nevada. Westinghouse Government Service, TTR's operations and maintenance contractor, performs most all environmental program functions.

This Annual Site Environmental Report (ASER), which is published to inform the public about environmental conditions at TTR, describes environmental protection programs and summarizes the compliance status with major environmental laws and regulations during Calendar Year (CY) 2001.

TTR is located within the boundaries of the Nevada Test and Training Range (NTTR) withdrawal. The principal DOE activities performed at TTR are stockpile reliability testing, research and development (R&D) testing support of structural development; arming, fusing, and firing systems testing; and testing nuclear weapon delivery systems.

Environmental Snapshot



- *TTR's annual rainfall is 4 inches on the desert floor and 12 inches in the mountains.*
- *The NTTR land withdrawal generally provides a positive effect on local plant and animal life species since it is relatively undisturbed by human activity.*

In 1963, Project Roller Coaster included a series of four nuclear weapons destruction tests, which left plutonium dispersal in the surrounding soils. The DOE/NNSA, Nevada (NV) office is responsible for the remediation of environmental restoration (ER) and other sites, while Sandia Corporation is responsible for environmental compliance.



Missile Launch from Tonopah Test Range

Sandia Corporation's TTR is located on 336,665 acres within the boundaries of the NTTR withdrawal and is used to support DOE/NNSA and U.S. Air Force (USAF) activities and missions. TTR is operated by Sandia Corporation, a subsidiary of Lockheed Martin Corporation which is administered by the DOE/NNSA, Office of Kirtland Site Operations (OKSO) through the Albuquerque Operations Office (AL). As the operations and maintenance contractor for TTR, Westinghouse Government Service performs most all environmental program functions, including environmental media sampling, wastewater effluent and drinking water monitoring, spill response, and waste management operations. Westinghouse Government Service also supports TTR during tests by operating optics equipment, recovering test objects, and performing radiography.

This ASER is prepared in accordance with the following DOE Orders that pertain to environmental protection and management:

- DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990);
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1993);
- DOE Order 231.1, *Environment, Safety, and Health Reporting*, Change 2 (DOE 1996a);
- DOE M 231.1-1, *Environment, Safety, and Health Reporting Manual*, as amended by DOE Order 470.2A (DOE 2000);
- DOE Order 435.1, *Radioactive Waste Management* (DOE 2001a); and
- DOE/AL Order 5400.2A, *Environmental Compliance Issue Coordination* (DOE 1993a).

This ASER summarizes data from environmental protection and monitoring programs at TTR through December 31, 2001. The status of environmental programs summarized in this ASER includes waste management, air, water, terrestrial monitoring and surveillance, the ER Project, and the National Environmental Policy Act (NEPA). DOE Order 5400.1 specifies the requirements for environmental monitoring conducted at and around the TTR site. The ASER represents an important component of DOE and Sandia Corporation's effort to keep the public informed about environmental conditions at DOE/NNSA facilities.

1.1 TTR HISTORY AND OPERATIONS

In 1940, President Roosevelt established the "Las Vegas Bombing and Gunnery Range" (now referred to as NTTR), which is part of the Nellis Air Force Base (NAFB) Complex. The NAFB Complex, located eight miles north of Las Vegas, Nevada, includes several auxiliary small arm ranges, and the NTTR—divided into a North Range and a South Range (Figure 1-1). The Nevada Test Site (NTS) is located between these two ranges. The entire NAFB Complex is comprised of approximately three million acres. TTR is located 32 miles (mi) southeast of Tonopah, Nevada.

TTR Site Characteristics

The topography at TTR is characterized by a broad, flat, valley bordered by two north and south trending mountain ranges: the Cactus Range to the west (occurring mostly within the boundaries of TTR) and the Kawich Range to the east. Cactus Flat is the valley floor where the main operational area of TTR is located. An area of low hills outcrops in the south. Elevations within TTR range from 5,347 ft at the valley floor to 7,482 ft at Cactus Peak. The elevation within the town of Tonopah is 6,030 ft.

TTR Site Selection

The TTR was eventually selected as a bombing range after similar facilities at the Salton Sea Test Base in California, as well as Yucca Flat on the NTS, became inadequate. By the mid-1950s, the atmosphere at the Salton Sea Test Base became permeated with haze, which limited visibility and hampered photography. Nevada's Yucca Flat site also became inadequate due to the increasing emphasis on low-altitude approaches and deliveries that required flat terrain and a long approach corridor. The TTR site was located in the northwest corner of the then Las Vegas Bombing and Gunnery Range. The site, which was approximately seven times the size of the Salton Sea Test Base, was well suited because it had immense areas of flat terrain needed for the increasing use of rockets and low-altitude, high-speed aircraft operations. The area was withdrawn in 1956 and TTR became operational in 1957 to operate and test new weapon systems. In the years following World War II, facilities that were built at TTR were originally designed and equipped to gather data on aircraft delivered inert test vehicles under U.S. Atomic Energy Commission (AEC) cognizance (now DOE). Over the years, the facilities and capabilities at TTR were expanded to accommodate tests related to the DOE/NNSA's Weapons Ordnance Program.

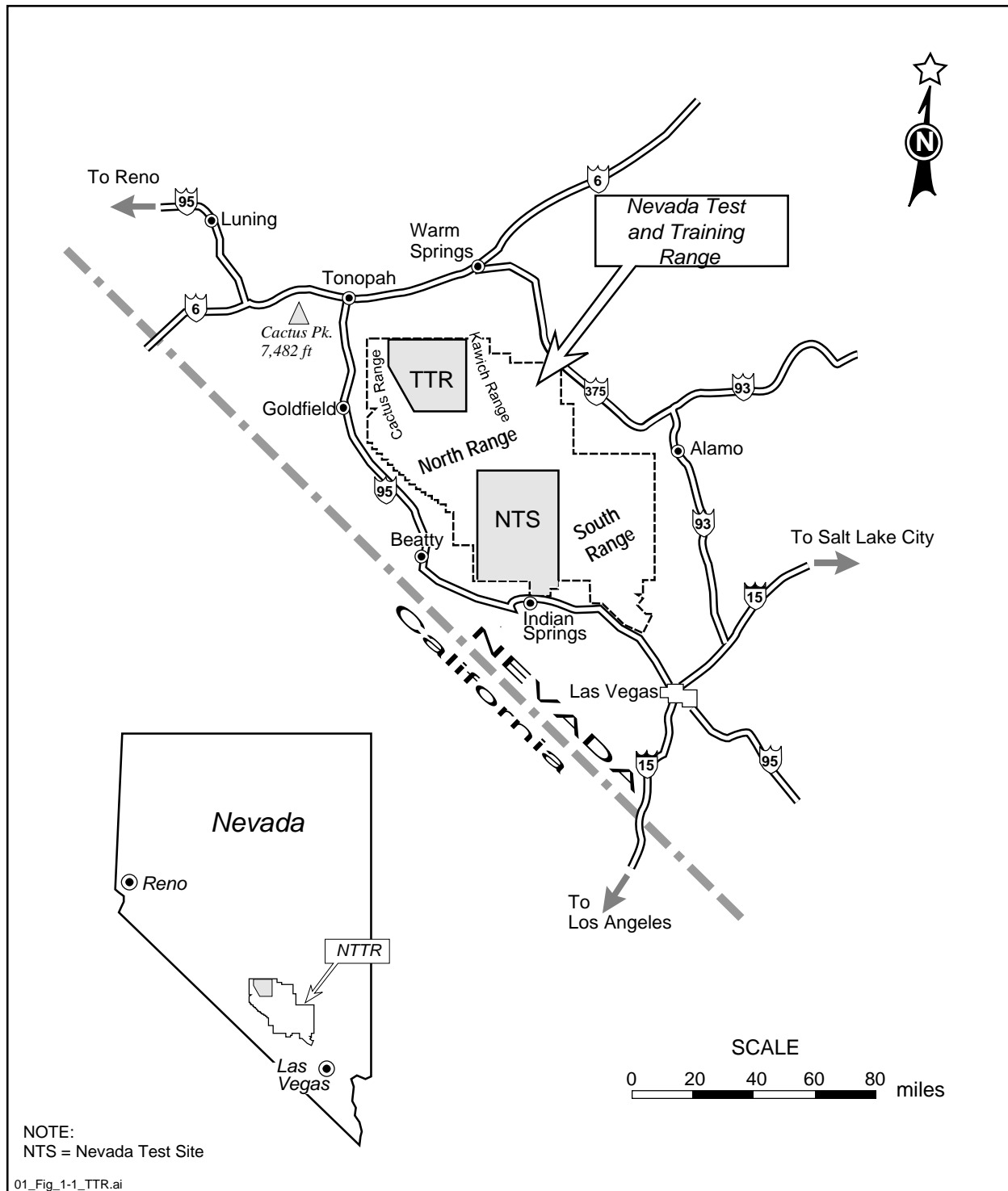


FIGURE 1-1. Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada

Operations Control Center

The Main Compound in Area 3 is the heart of the test range activities. The Operations Control Center controls and coordinates all test functions and affords a 360-degree view of the site. During test operations, the test director, range safety officer, test project engineer, camera controller, and range communicator operate the consoles in the Operations Control Center to control and coordinate all test functions.

Another important location at the range is Area 9, which has weapons storage facilities and is used to conduct ground-to-air rocket launching tests.

TTR Activities

Principal DOE activities at TTR include stockpile reliability testing; R&D testing support of structural development; arming, fusing and firing systems testing; and testing nuclear weapon delivery systems. No nuclear devices are tested at TTR. TTR is instrumented with a wide array of signal tracking equipment including video, high-speed cameras, radar tracking devices used to characterize ballistics, aerodynamics, and parachute performance on artillery shells, bomb drops, missiles, and rockets.

In recent years, specific test activities at TTR have consisted of the following:

- Air drops (trajectory studies of simulated weapons);
- Gun firings;
- Ground-launched rockets (study of aeroballistics and material properties);
- Air-launched rockets (deployed from aircraft);
- Explosive testing (e.g., shipping and storage containers);
- Static rocket tests (related to the Trident Submarine Program); and
- Ground penetrator tests.

These activities require a remote range for both public safety and to maintain national security. The majority of test activities at TTR occur within Cactus Flat, a valley with almost no topographical relief flanked by mountains and hills.

Site Responsibility

On October 1, 1997, a Memorandum of Agreement (MOA) was signed between DOE/AL and the DOE/NV in regards to operational test activities at TTR (DOE 1994). It was determined that DOE/OKSO is responsible for the oversight of

TTR; however, DOE/NV will continue with the oversight of ER activities at TTR. Environmental program management, as discussed in this ASER, is a joint effort between Sandia Corporation's TTR and Sandia National Laboratories, NM (SNL/NM) employees and contractors with oversight from DOE/OKSO.

1.2 SITE DESCRIPTION AND DEMOGRAPHICS

TTR is located within the NTTR at the northern boundary. The area north of the TTR boundary is sparsely populated public lands administered by both the U.S. Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). The land is currently used to graze cattle. To the east of TTR, and within the NTTR, is the Nevada Wild Horse Range, which is also administered by the BLM.

The nearest residents are located in the town of Goldfield (population 659), approximately 22 mi west of the site boundary. The town of Tonopah (population 4,400) is the next largest population center, approximately 30 mi northwest of the site (DOC 2002). Las Vegas, Nevada is 140 mi from TTR. The total population within an 50-mi radius around TTR is approximately 7,000, which includes the potential population at TTR if all housing units at the site were occupied.

1.3 REGIONAL GEOLOGY, HYDROLOGY, CLIMATE, AND FAUNA

Geology

The regional area around TTR is located in the western part of the Basin and Range geophysical province. This area is marked by horst and graben topography, a system of mountains and down-dropped fault valleys formed through regional extension. TTR lies northeast of the Walker Lane, a zone of transcurrent faulting and shear, and the Las Vegas Valley shear zone to the southeast (Sinnock 1982).

The Cactus Range to the west of TTR is the remnants of a major volcanic center consisting of relatively young (six million-year-old) folded and faulted tertiary volcanics. This range is one of at least five northwest trending, raised structural blocks that lie along the Las Vegas Valley-Walker Lane lineaments (ERDA 1975).

Surface Water

Drainage patterns within and near TTR are intermittent (ephemeral stream channels) and end in closed basins. Ephemeral streams occasionally carry spring runoff to the center of Cactus Flat where there is a string of north-south trending dry lakebeds; however, due to the high rate of evaporation, little is recharged to the groundwater (DRI 1991).

There are several small springs within the Cactus and Kawich Ranges. Three springs occur within TTR boundaries: Cactus, Antelope, and Silverbow Springs. Water from these springs does not travel more than several tens of meters dissipating rapidly through evaporation and infiltration. The effect on the landscape is purely local.

Groundwater

TTR obtains its water from local wells. The U.S. Geological Survey (USGS) has recorded groundwater depths from 21 to 454 ft at the site. Groundwater is encountered at the Antelope Mine well in the Cactus Range at 21 ft and at the EH2 well near the TTR Airport at 454 ft. The depth to groundwater at the Area 9 well located at the north end of the site is approximately 131 ft. South of the Area 9 well, groundwater is encountered at 361 to 394 ft in Area 3. The static water level at the main water supply well (Well 6) is approximately 350 ft.

Climate

The climate at TTR is mild and dry, but, as is typical of high deserts, is subject to large diurnal and seasonal changes in temperature—from a record high of 38.8 °C (102 °F) to a record low of -4 °C (24 °F) (Schaeffer 1970). July and August are the hottest months with temperatures ranging from the 90s during the day and dropping to the 50s at night. Clear, sunny days with light to moderate winds are usual.

Rainfall is dependent on elevation. The annual average rainfall at the desert floor is 4 inches and 12 inches in the mountains. The primary rainfall season is in the summer with a lesser rainy season in the winter (USAF 1978).

Winds are mostly from the northwest from late fall to spring, and are influenced by the Pacific air flow patterns coming over the Sierra Nevada Mountains in California. From summer through early fall, the winds generally shift to a southeasterly direction blowing in from the Gulf of Mexico. Dust storms are common in the spring and dust devils occur in the summer.

Vegetation

Temperature extremes and arid conditions of the high desert limit vegetation coverage. Sparse vegetation that occurs in Cactus Flat is predominantly range grasses and low shrubs typical of the Great Basin Desert flora (ERDA 1975; EG&G 1979).

Vegetation is divided into two basic types at the site by elevation—salt desert shrub in the low areas and northern desert shrub in the higher elevations (USAF 1978, DRI 1991). Salt desert shrub is characteristic of poorly drained soils and is common along dry lakebeds. Specific plants in this group include shadscale (a type of salt bush) (*Atriplex confertifolia*), Russian thistle (*Salsola kali*), and sagebrush (*Artemisia tridentata*). Northern desert shrub, found in the Cactus Range, includes a variety of sagebrush, rabbitbrush (*Chrysothamnus nauseosus*), squirrel tail (*Elymus longifolius*), juniper (*Juniperus* varieties), and Nevada bluegrass (*Poa nevadensis*). Joshua trees (*Yucca brevifolia*) and juniper grow in the transition zone at the base of the mountains.

Wildlife

The Nevada Wild Horse Range and other wild horse land-use areas compose a significant portion of the North Range with herds common in Cactus and Gold Flats, Kawich Valley, Goldfield Hills, and the Stonewall Mountains. Hundreds of wild horses (*Equus caballus*) graze freely throughout TTR and activities on-site have had little affect on the horse population or their grazing habits. The BLM routinely rounds up a portion of the herds for dispersal through the Horse Adoption Program.

Other mammals common to the area include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), kit fox (*Vulpes macrotis*), bobcat (*Zynx rufus*), coyote (*Canis latrans*), and gray fox (*Urocyon cinereoargenteus*). To a lesser extent, bighorn sheep (*Ovis canadensis*), mountain lion (*Felis concolor*), and burros (*Equus asinus*) are also present (USAF 1978, DRI 1991). Common birds include various raptor species.

In general, the NTTR land withdrawal has provided a positive effect on local plant and animal life. Since much of the withdrawal area is undisturbed by human activity, large habitat areas are protected from the affects of public use. For example, recreational off-road vehicles can cause significant impacts to desert flora and fauna and it can take years for fragile desert ecosystems to recover from disturbances.

1.4 CLEAN SLATE AND DOUBLE TRACKS SITES

In May and June 1963, Project Roller Coaster included a series of four nuclear weapons destruction tests that resulted in plutonium dispersal in the surrounding soils. Three of these tests were conducted within the boundaries of TTR; the fourth was conducted on the NTTR just west of TTR. The three Project Roller Coaster test sites at TTR are referred to as Clean Slates 1, 2, and 3 (Figure 1-2). The fourth test site at NTTR is referred to as Double Tracks. In 1996, the Double Tracks was closed after soil contamination was remediated to a level of less than or equal to 200 picocurie per gram (pCi/g) of transuranics.

Table 1-1 summarizes test information related to the four Project Roller Coaster sites. DOE/NNSA/NV is responsible for the remediation of these and all other ER sites at TTR. Sandia Corporation will continue to be responsible for environmental compliance at these sites.

The initial cleanup of each Clean Slate site was conducted shortly after each test. Test-related debris was bladed into a hole at test ground zero

and backfilled. An initial fence was built around each test area where the soil contamination was set at approximately 1,000 $\mu\text{g}/\text{m}^2$ of plutonium. The soil survey was conducted on 61-m grids with a hand-held survey meter or field instrument for the detection of low-energy radiation (FIDLER). In 1973, additional outer fences were set at 40 pCi/g of plutonium in soil also using the hand-held meter method. Soil sampling is conducted periodically at these sites and the areas are visually inspected twice a year to determine whether any fence repairs are required. Any horses that may wander inside the fenced areas are promptly removed.

In 1977, an aerial radiological survey was performed by EG&G, Inc. for the Nevada Applied Ecology Group (NAEG) (EG&G 1995). The aerial radiological surveys were undertaken to supplement the FIDLER and previous soil sample measurements of transuranics. The objective was to determine the extent of surficial distribution of plutonium and other transuranic elements dispersed during the Project Roller Coaster tests. Radiation isopleths showing soil activity due to americium-241 (Am-241), plutonium-239 (Pu-239), and plutonium-240 (Pu-240) were drawn for each area. The cumulative area of the diffuse sources,

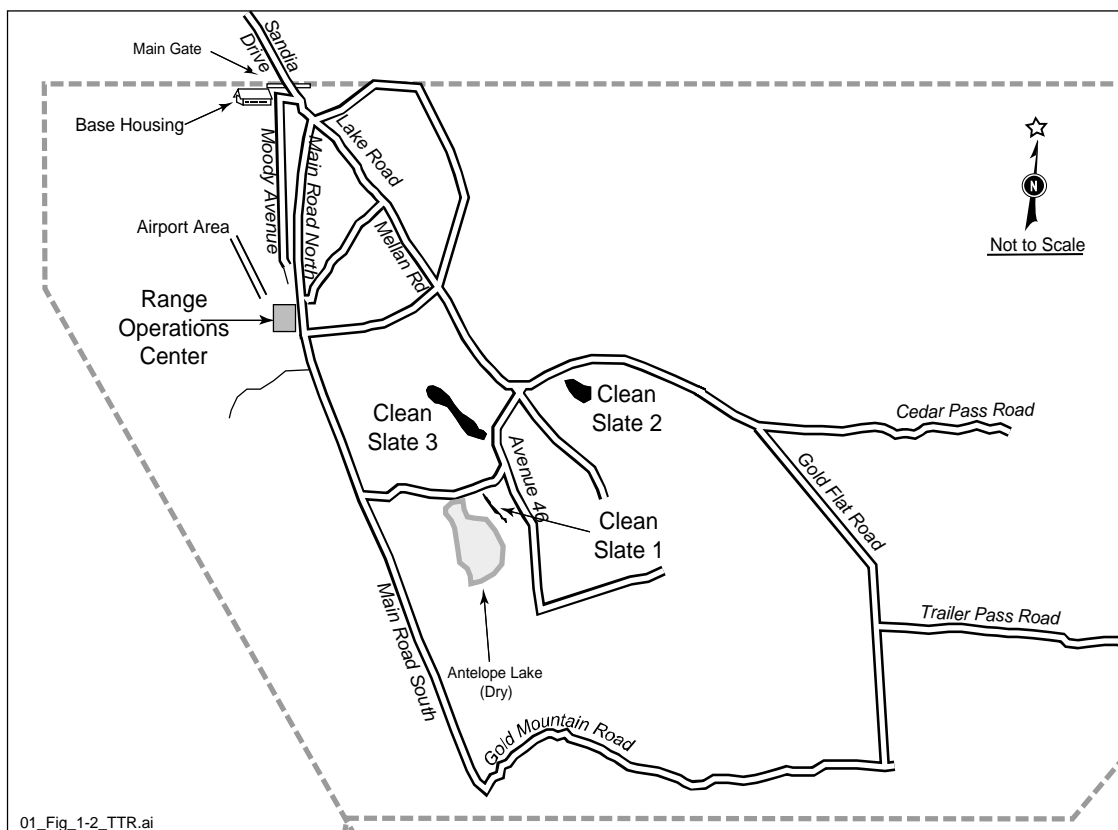


FIGURE 1-2. Location of Facilities Operated by SNL/NV at TTR

TABLE 1-1. Project Roller Coaster Test Information

Test Name	Date of Test	Location	Status
Clean Slate 1	May 25, 1963	TTR	Closed
Clean Slate 2	May 31, 1963	TTR	Remediation phase
Clean Slate 3	June 9, 1963	TTR	Remediation has not started
Double Tracks	May 15, 1963	NTTR, North Range (west of TTR)	Closed

NOTE: TTR = Tonopah Test Range

NTTR = Nevada Test and Training Range

Source : Sampling and Analysis Plan for Clean Slate 1, September 1996
(IT 1996)

as determined by the aerial radiological survey, is 20 million m². The results of the survey found transuranic contamination outside the fenced area in the downwind direction (EG&G 1995).

Air Monitoring at ER sites

Remediation activities were conducted at Clean Slate 1 in 1997. The Desert Research Institute (DRI) collected air monitoring data from several locations in the vicinity of Clean Slate 1 before, during, and after remediation activities. Although these data have been validated, they have only as of yet been presented to DOE/NV in the form of a draft report (DRI 1997). A final report is pending. Bechtel Nevada has two air monitoring stations available for use at TTR. DOE/NV suspended air monitoring in April 2000 and will not resume until active remediation efforts at the Clean Slate sites begin again. Clean Slates 1, 2, 3, and Double Tracks and a number of other sites at the Nevada Test Site are Corrective Action Units (CAUs) in the Soils Project, which has been suspended because of cleanup level issues.

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Compliance Summary

In this Chapter ...

<i>Compliance Status with Federal Regulations</i>	<i>2-2</i>
<i>2001 Audits</i>	<i>2-8</i>
<i>2001 Issues and Actions for TTR</i>	<i>2-8</i>
<i>Environmental Permits</i>	<i>2-8</i>
<i>Occurrence Reporting</i>	<i>2-8</i>

Chapter Summary

Sandia Corporation is responsible for Environment, Safety, and Health (ES&H) compliance activities performed at Tonopah Test Range (TTR). There are 14 major environmental regulations and statutes applicable to Sandia Corporation at TTR. A variety of programs at TTR work together to strive for 100 percent compliance with federal, state, and locally mandated regulations, TTR must adhere to strict reporting and permitting requirements.

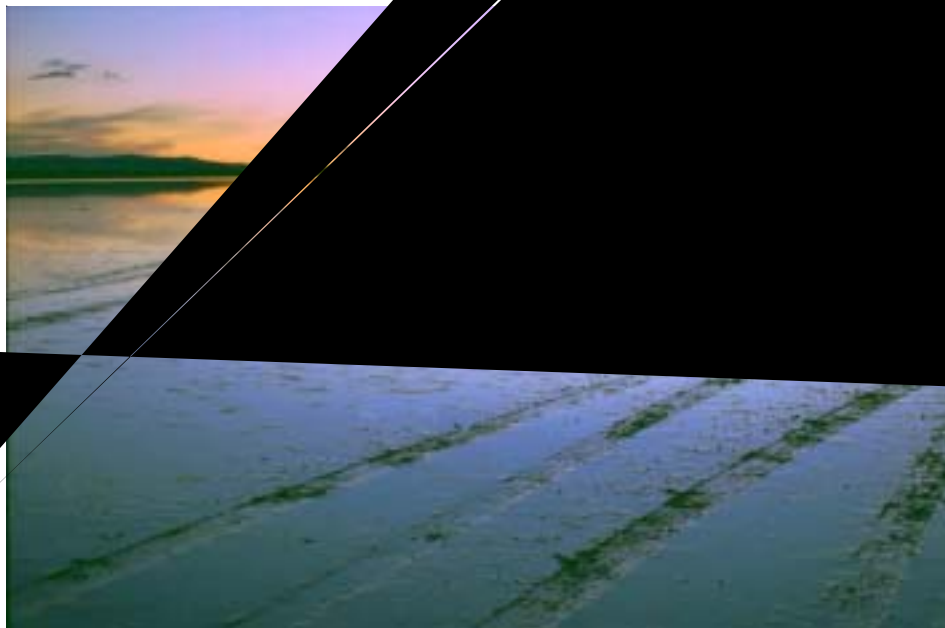
External and internal audits were conducted in 2001 to identify any issues that may have arisen from operations at TTR. There were no reportable environmental occurrences at TTR in 2001.

In 2001, Sandia Corporation and Westinghouse Government Service cooperated to ensure that TTR was in compliance with all permitting requirements.

Environmental Snapshot

- *There were no excursions or other permit violations with regard to wastewater discharges at TTR in 2001.*
- *In 2001, Sandia Corporation submitted five National Environmental Policy Act (NEPA) Checklists to the U.S. Department of Energy (DOE) for proposed projects at TTR.*

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Sunset at Unit Lake

This chapter discusses Sandia Corporation's responsibility and the status of ES&H compliance with federal environmental statutes, regulations, executive orders (EOs), and DOE Orders applicable to TTR. Environmental audit summaries, occurrence reporting, and environmental permit status for 2001 are presented at the end of this chapter.

Sandia Corporation and the DOE, National Nuclear Security Administration (NNSA) strive to meet 100 percent compliance with environmental laws, regulations, and other requirements established by federal and state agencies. The State of Nevada administers most environmental regulations applicable to TTR. Specific state regulations listed in Appendix A include regulations governing solid and hazardous waste management, wildlife, wastewater effluent, and radiation control. Radionuclide air emission regulations are administered directly by the U.S. Environmental Protection Agency (EPA).

Sandia Corporation at TTR works in close cooperation with Sandia Corporation at Sandia National Laboratories, New Mexico (SNL/NM) to carry out environmental program activities and is responsible for environmental compliance at TTR. Westinghouse Government Service contracts to Sandia Corporation and performs or assists with most environmental program activities, such as air monitoring, water sampling, and waste characterization. Major federal laws applicable to environmental compliance at TTR are presented on page 2-3 (see shaded box).

2.1 COMPLIANCE STATUS WITH FEDERAL REGULATIONS

This section summarizes DOE and Sandia Corporation's compliance status with major environmental regulations, statutes, EOs, and DOE Orders that pertain to the environment.

2.1.1 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

CERCLA defines assessment activities and reporting requirements for inactive waste sites at federal facilities. As required by CERCLA, a Preliminary Assessment (PA) was submitted in 1988 for all facilities listed on the federal agency hazardous waste compliance docket. Sites with significant contamination were put on the National

Priorities List (NPL) for cleanup (EPA 2002). There are no NPL or "Superfund" sites located at TTR.

Additional CERCLA requirements are given in the Superfund Amendments and Reauthorization Act (SARA) Title III for reportable quantity (RQ) releases and chemical inventory reporting. Sandia Corporation at TTR was in full compliance with CERCLA and SARA in 2001.

2.1.2 Emergency Planning and Community Right-to-Know Act (EPCRA)

SARA Title III (also known as EPCRA) requires the submittal of a Toxic Release Inventory (TRI) report for chemical releases over a given threshold quantity (TQ). In 2001, release reporting limits for lead were dropped to 100 lbs. The TTR Firing Range released approximately 700 lbs per year of non-recovered lead. This information will be reported in the Reporting Year (RY) 2001 TRI Report. Table 2-1 summarizes Sandia Corporation's compliance with SARA Title III reporting requirements.

2.1.3 Resource Conservation and Recovery Act (RCRA)

Under the RCRA Hazardous Waste Permit Program (40 CFR 270), TTR is permitted as a "small quantity generator." Under this designation, hazardous waste can only be stored on-site for 180 days before it must be shipped off-site for treatment and disposal at an EPA-permitted facility. At TTR, hazardous waste shipments are scheduled to occur at least two to three times a year. In 2001, a total of 1,304 kg of RCRA waste was generated by Sandia Corporation activities at TTR. An additional 2,083 kg of non-RCRA waste was disposed of through the waste contractor. Recyclable waste totaling 6,024 kg, including used oil, was sent for recycling or disposed of through the waste disposal contractor. (Environmental Restoration [ER] Project waste is not included in these totals.)

Sanitary solid waste, which is also regulated under RCRA, is disposed of at landfills on-site. There is one Class II sanitary landfill in operation at TTR operated by the U.S. Air Force (USAF) Operations and Maintenance (O&M) contractor. The landfill is used cooperatively by all organizations at TTR.

Major Environmental Regulations & Statutes Applicable to TTR

Clean Air Act (CAA) and CAA Amendments (CAAA)

Provides standards to protect the nation's air quality

Clean Water Act (CWA)

Provides general water quality standards to protect the nation's water sources and byways

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances

Cultural resources acts

Includes various acts that protect archeological, historical, religious sites, and resources

Endangered Species Act (ESA)

Provides special protection status for federally-listed endangered or threatened species

Executive Orders (EOs)

Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and greening the government through leadership in environmental management

Federal Facility Compliance Act (FFCA)

Directs federal agencies regarding environmental compliance

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Controls the distribution and use of various pesticides

Migratory Bird Treaty Act (MBTA) of 1918

Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests

National Emission Standards for Hazardous Air Pollutants (NESHAP)

Specifies standards for radionuclide air emissions and other hazardous air releases

National Environmental Policy Act (NEPA)

Ensures that federal agencies review all proposed activities and include environmental consideration in agency decision-making

Resource Conservation and Recovery Act (RCRA)

Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (USTs)

Safe Drinking Water Act (SDWA)

Provides specific standards used for drinking water sources

Superfund Amendments and Reauthorization Act (SARA) SARA, Title III, also known as the

Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community

Toxic Substances Control Act (TSCA)

Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCBs)

TABLE 2-1. 2001 SARA Title III (or EPCRA) Reporting Requirements Applicable to TTR

Section	SARA Title III Section Title	Requires Reporting?		Description
		Yes	No	
302 - 303	Notification/ Plans	!		Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/OKSO, which distributes it to the required entities.
304	Emergency Notification		!	No RQ releases of an EHS, or as defined under CERCLA, occurred in 2001.
311-312	MSDSs/ Chemical Purchase Inventory Report	!		There are two "Community Right-to-Know" reporting requirements: (a) TTR completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) TTR provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA's alternative MSDS reporting, which is detailed in 40 CFR Part 370.21.
313	Toxic Chemical Release Forms	!		EPCRA, Section 313, requires that facilities that use toxic chemicals listed in SARA Title III over a threshold value must submit a TRI report. For RY 2001, a report was submitted for lead.

NOTE: MSDS = Material Safety Data Sheets (gives relevant chemical information)

RQ = reportable quantity

EHS = extremely hazardous substance

TRI = Toxic Release Inventory

DOE = U.S. Department of Energy

OKSO = Office of Kirtland Site Operations

EPA = U.S. Environmental Protection Agency

NNSA = National Nuclear Security Administration

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

RY = reporting year

Underground Storage Tanks (USTs) – RCRA, Subchapter I (40 CFR 280) sets forth requirements for USTs that contain hazardous materials or petroleum products. There are no USTs requiring registration at TTR. The last five USTs (two diesel tanks and two gasoline tanks were removed from Area 3 at the site of a former gas station and one diesel tank was removed from Area 9 that had supplied generator fuel) were removed in August 1995.

2.1.4 Federal Facility Compliance Act (FFCA)

The FFCA amendments to RCRA specifically address Land Disposal Restriction (LDR) requirements for the treatment of mixed waste (MW) at federal facilities. Since TTR does not generate MW and currently has no MW stored on-site, this statute is not applicable to Sandia Corporation's operations at TTR.

2.1.5 Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990

CAA and CAAA of 1990 requirements are regulated by the State of Nevada air quality regulations. Air Emissions from non-radionuclide sources, such as generators and other combustion sources, are permitted under a Class II Air Quality Permit. Sandia Corporation tracks emissions and pays a fee to the State of Nevada based on the total standard tons emitted. Sandia Corporation met all air quality permit conditions in 2001.

NESHAP Compliance

The EPA retains compliance authority for all radionuclide air releases, which are regulated by NESHAP and implemented under 40 CFR 61, Subpart H.

The Clean Slate sites, as discussed in Chapter 1, have been the only source of radionuclide air emissions at TTR. Continuous air monitoring was conducted from February 22, 1996 to February 25, 1997 (SNL 1997). The TTR Airport was determined to be the location of the maximally exposed individual (MEI). The result of 0.024 millirems per year (mrem/yr) was below the threshold of 0.1 mrem/yr for which continuous air monitoring would be required and approximately 400 times less than the EPA standard of 10 mrem/yr. The *NESHAP Annual Report for CY 2001* and Chapter 4 of this report discuss these monitoring results (SNL 2002).

2.1.6 Clean Water Act (CWA)

Wastewater effluents and potable water supplies are regulated under the CWA and State of Nevada water pollution and sanitary waste systems regulations. The State of Nevada, Bureau of Health Protection Services and the Nevada Department of Environmental Protection (NDEP) administer regulations relevant to wastewater discharges. At TTR, wastewater is discharged to the sewer system connected to the USAF sewage lagoon and to six septic tank systems.

There were no excursions or other permit violations in 2001 with respect to wastewater discharges.

Storm Water

The issuance of a National Pollutant Discharge Elimination System (NPDES) storm water permit is generally based on whether or not storm water runoff is discharged to "Waters of the U.S." This definition includes rivers, lakes, streams, and swamps, as well as channels and arroyos that lead

to waters that are currently used, have been used in the past, or may be susceptible for use in interstate or foreign commerce. The TTR site is primarily a closed basin with runoff evaporating or infiltrating to the ground. The USAF has permitted its airfield and Area 10 for storm water runoff and have cognizance over all storm water issues at the site. Currently, Sandia Corporation does not conduct any activities at TTR that require storm water permitting or monitoring.

2.1.7 Safe Drinking Water Act (SDWA)

Sandia Corporation meets standards for drinking water as defined in the SDWA and State of Nevada public water supply and public water systems regulations. Well 6 provides all drinking water for Sandia Corporation's operations at TTR and is operated under a permit issued by the State of Nevada. Sandia Corporation remained in compliance with all Well 6 permit requirements in 2001.

2.1.8 Toxic Substances Control Act (TSCA)

Compliance with the TSCA at TTR primarily concerns the management of asbestos and polychlorinated biphenyls (PCBs). As defined by the TSCA, any material with greater than or equal to 500 parts per million (ppm) is considered a "PCB"; materials with greater than or equal to 50 ppm, but less than 500 ppm are considered as "PCB-contaminated." In 1993, sampling was performed on TTR transformers to determine if PCBs were present in the soil (IT 1993). All samples contained less than 50 ppm of PCBs.

2.1.9 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Chemical pesticides used at TTR include herbicides, rodenticides, and insecticides, as required. All chemicals used are EPA-approved and applied in accordance with applicable label guidelines and regulations. Sandia Corporation retains records of the quantities and types of pesticides that are used as well as Material Safety Data Sheets (MSDSs) for each pesticide. There were no violations of the FIFRA in 2001.

2.1.10 National Environmental Policy Act (NEPA)

NEPA requires federal agencies and private entities that perform federally-sponsored projects, including DOE, to analyze potential impacts to the environment during the early planning of proposed actions. If the proposed action is determined to

be environmentally “significant,” the agency must prepare an environmental assessment (EA) or an environmental impact statement (EIS) before an irretrievable commitment of resources or funding occurs. Although a major objective of NEPA is to preserve the environment for future generations, the law does require an agency to select the proposed action alternative with the least environmental impacts. One major intent of the law is to ensure that federal agencies are aware of the potential environmental impacts associated with their operations and are able to make informed decisions based on this information. NEPA also mandates that the decision process be open for public review.

Activities at TTR conducted by Sandia Corporation are included in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE 1996b). Sandia Corporation provides technical guidance for all NEPA issues at TTR. Sandia Corporation’s NEPA Program is under the direction of the DOE/NNSA, Office of Kirtland Site Operations (OKSO).

2001 NEPA Documentation

During 2001, Sandia Corporation submitted five NEPA Checklists to DOE/NNSA/OKSO for proposed projects at TTR that were determined to be within the Nevada Test Site (NTS) EIS envelope.

2.1.11 Endangered Species Act (ESA)

The ESA applies to both private individuals and federal agencies. Federal agencies must ensure that any action authorized, funded, or carried out by them will not jeopardize the continued existence of a threatened or endangered species, or result in adverse modifications of its habitat. The ESA is addressed under the NEPA Program. If potentially significant impacts to sensitive species or habitats are found as a result of the proposed action, an EA or an EIS must be prepared.

Table 2-2 lists all endangered, threatened, and sensitive species occurring within Nye County; therefore, having the potential to occur at TTR.

2.1.12 Migratory Bird Treaty Act (MBTA)

The MBTA of 1918, as amended, was established between the conventions of Canada, Japan, Russia, Mexico, and the United States. The MBTA prevents the taking, killing, possession, transportation and importation of migratory birds,

their eggs, parts, and nests. Federal institutions are not exempt from the MBTA. New guidance is being developed by the U.S. Fish and Wildlife Service to assist federal institutions in interpreting this Act. At Sandia Corporation’s TTR, MBTA is coordinated with NEPA compliance reviews.

2.1.13 Cultural Resources Acts

Federal cultural resources management responsibilities are applicable to activities at TTR. These include but are not limited to compliance with the following laws and their associated regulations:

- National Historic Preservation Act (NHPA)
- Archaeological Resources Protection Act (ARPA)
- American Indian Religious Freedom Act (AIRFA)

DOE/NNSA/OKSO is responsible for determining the level of applicability of cultural resources requirements. In 2001, Sandia Corporation’s operations did not impact any known cultural resources sites at TTR.

2.1.14 Environmental Compliance Executive Orders (EOs)

EO 11988, *Floodplain Management*, as amended, and EO 11990, *Protection of Wetlands*, as amended, require evaluation of the potential effects of actions taken in these environmentally sensitive areas. There are no floodplains or significant wetlands at TTR; however, some very limited wetlands exist in the vicinity of several springs. These provide an important source of drinking water for wildlife in the area. Sandia Corporation complies with all applicable mandates stated in these EOs.

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended, requires that to the greatest extent practicable and permitted by law, and consistent with the principles set forth in the Report on the National Performance Review (Gore 1993), each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. Sandia Corporation must include in the assessment

TABLE 2-2. Protected Species Potentially Occurring in Nye County, Nevada

Common Name	Scientific Name	Federal Status	State of Nevada Status
PLANTS			
Beatley milkvetch	<i>Astragalus beatleyae</i>	--	State Protected
Sodaville milkvetch	<i>Astragalus lentiginosus</i> var. <i>sesquimetralis</i>	--	State Protected
Halfring milkvetch	<i>Astragalus mohavensis</i> var. <i>hemigyris</i>	--	State Protected
Milkvetch	<i>Astragalus phoenix</i>	Threatened	State Protected
Spring-loving centaury	<i>Centaurium namophilum</i>	Threatened	State Protected
Ash Meadows sunray	<i>Enceliopsis nudicaulis</i> var. <i>corrugata</i>	Threatened	State Protected
Sunnyside green gentian	<i>Frasera gypsicola</i>	--	State Protected
Ash Meadows gumplant	<i>Grindelia fraxinopratenensis</i>	Threatened	State Protected
Ash Meadows ivesia	<i>Ivesia kingii</i> var. <i>eremica</i>	Threatened	State Protected
Ash Meadows blazingstar	<i>Mentzelia leucophylla</i>	Threatened	State Protected
Amargosa niterwort	<i>Nitrophila mohavensis</i>	Endangered	State Protected
Sand cholla	<i>Opuntia pulchella</i>	--	State Protected
Williams combleaf	<i>Polyctenium williamsiae</i>	--	State Protected
Tonopah fishhook cactus	<i>Sclerocactus nyensis</i>	--	State Protected
Blaine Pincushion	<i>Sclerocactus blainei</i>	--	State Protected
INSECTS			
Ash Meadows naucorid	<i>Ambrysus amargosus</i>	Threatened	
FISH			
White River desert sucker	<i>Catostomus clarki intermedius</i>	--	State Protected
Moorman White River springfish	<i>Crenichthys baileyi thermophilus</i>	--	State Protected
Railroad Valley springfish	<i>Crenichthys nevadae</i>	Threatened	State Protected
Devils Hole pupfish	<i>Cyprinodon diabolis</i>	Endangered	State Protected
Ash Meadows Amargosa pupfish	<i>Cyprinodon nevadensis mionectes</i>	Endangered	State Protected
Warm Springs Amargosa pupfish	<i>Cyprinodon nevadensis pectoralis</i>	Endangered	State Protected
Pahrump poolfish	<i>Empetrichthys latos latos</i>	Endangered	State Protected
Big Smoky Valley tui chub	<i>Gila bicolor</i> ssp.	--	State Protected
Hot Creek Valley tui chub	<i>Gila bicolor</i> ssp.	--	State Protected
Little Fish Lake Valley tui chub	<i>Gila bicolor</i> ssp.	--	State Protected
Railroad Valley tui chub	<i>Gila bicolor</i> ssp.	--	State Protected
White River spinedace	<i>Lepidomeda albivallis</i>	Endangered	State Protected
Moapa dace	<i>Moapa coriacea</i>	Endangered	State Protected
Lahontan cutthroat trout	<i>Oncorhynchus clarki henshawi</i>	Threatened	State Protected
Big Smoky Valley speckled dace	<i>Rhinichthys osculus lariversi</i>	--	State Protected
Nevada speckled dace	<i>Rhinichthys osculus nevadensis</i>	Endangered	State Protected
AMPHIBIANS			
Amargosa toad	<i>Bufo nelsoni</i>	--	State Protected
REPTILES			
Banded Gila monster	<i>Heloderma suspectum cinctum</i>	--	State Protected
MAMMALS			
Spotted bat	<i>Euderma maculatum</i>	--	State Protected
BIRDS			
Northern goshawk	<i>Accipiter gentilis</i>	--	State Protected
Western burrowing owl	<i>Athene cunicularia hypugaea</i>	--	State Protected
Ferruginous hawk	<i>Buteo regalis</i>	--	State Protected
Swainson's hawk	<i>Buteo swainsoni</i>	--	State Protected
Sage grouse	<i>Centrocercus urophasianus</i>	--	State Protected
Western snowy plover	<i>Charadrius alexandrinus nivosus</i>	--	State Protected
Black tern	<i>Chlidonias niger</i>	--	State Protected
Western least bittern	<i>Ixobrychus exilis hesperis</i>	--	State Protected
Flammulated owl	<i>Otus flammeolus</i>	--	State Protected
Phainopepla	<i>Phainopepla nitens</i>	--	State Protected
White-faced Ibis	<i>Plegadis chihi</i>	--	State Protected
Yuma clapper rail	<i>Rallus longirostris yumanensis</i>	Endangered	State Protected

of its operations any disproportionate impacts on minority or low-income populations within the area of influence of the Laboratories' operations.

EO 13148, *Greening the Government Through Leadership in Environmental Management*, requires federal agencies to ensure that "all necessary actions are taken to integrate environmental accountability into agency day-to-day decision-making and long-term planning processes, across all agency missions, activities, and functions." Among the primary agency goals is support to the development and implementation of environmental compliance audit programs and policies "that emphasize pollution prevention as a means to both achieve and maintain environmental compliance." Sandia Corporation is working under guidance from DOE/NNSA/OKSO towards compliance with this Executive Order.

2.2 2001 AUDITS

Table 2-3 lists audits conducted in 2001, including an assessment made by Sandia Corporation.

2.3 2001 ISSUES AND ACTIONS FOR TTR

Ongoing self-assessments of Sandia Corporation's compliance status continue to identify compliance issues. Resolution of these issues is coordinated with regulatory agencies to ensure that they are adequately addressed. The following sections highlight current issues of concern or interest at TTR.

Federal Facility Agreement and Consent Order (FFACO) Compliance for ER Activities

An ongoing action started in 1996 is the FFACO with the State of Nevada. This agreement was implemented in May 1996 between the State of Nevada, DOE, and the U.S. Department of Defense (DoD) (DoD/DOE/State of NV 1996). All DOE cleanup activities in the State of Nevada must be conducted in conformance with the requirements of this agreement. The FFACO is an enforceable agreement with stipulated penalties for violations. The ER sites for which DOE has

assumed responsibility, and which are subject to the FFACO:

- NTS,
- Areas within TTR,
- Areas within the NTTR,
- Central Nevada Test Area, and
- Project Shoal Area (east of Carson City in Churchill County).

A summary of DOE/NNSA's ER sites in Nevada can be found in the FFACO report (DoD/DOE/State of NV 1996). The list of sites has been modified for consistency with NDEP requirements and grouped into Corrective Action Units (CAUs), which are listed by Corrective Action Site (CAS) numbers. Each CAU is listed in the FFACO under Appendices II (inactive CAUs) and III (active CAUs) and are updated every six months. A listing of ER sites located at TTR is shown in Chapter 3, Table 3-1.

2.4 ENVIRONMENTAL PERMITS

Environmental compliance permits for TTR include those for potable water supply, sewage, and specific air emission units, such as generators. The permit application and registration of Sandia Corporation activities at TTR are issued directly by the State of Nevada to either DOE/NNSA, Nevada (NV) or DOE/NNSA/OKSO and administered by Westinghouse Government Service. Sandia Corporation and Westinghouse Government Service ensure that all permit conditions are met. Table 2-4 lists all permits and registrations in effect in 2001. TTR was in full compliance with all permitting requirements for 2001.

The State of Nevada Bureau of Health Protection Services renews the permit for Well 6 (NY-3014-12NC) annually. Permit updates are obtained annually and copies are forwarded to DOE/NNSA/OKSO and Sandia Corporation.

2.5 OCCURRENCE REPORTING

There were no reportable environmental occurrences in 2001.

TABLE 2-3. Summary of Environmental Audits Performed at TTR in 2001

Audit Title	Date	Results Summary
Annual SPCC Inspection (SNL/NM)	March 2001	There were no violations. Several minor recommendations were made.
State of Nevada, Air Quality Audit	July 2001	No violations

NOTE: SNL/NM = Sandia National Laboratories, New Mexico
 SPCC = Spill Prevention, Control, and Countermeasures

TABLE 2-4. Summary of Permit Ownership at TTR

Permit Type and Location	Permit Number	Issue Date	Expiration Date	Comments
Air Quality Permits				
Open Burn Variance (Fire Extinguisher Training)	New with each issue	Quarterly	Quarterly	State of Nevada
Class II Air Quality Operation Permit	AP9611-0680.01	July 23, 2001	July 23, 2006	1 3 x 5 Screening Plant 1 7 x 7 Screening Plant Generators (53 emission units) Boilers (7 emission units) Maintenance Activities (5 emission units) Propane Storage Tanks (23 emission units) Surface Area Disturbance (> 5 acres)
RCRA - Hazardous Waste				
Hazardous Waste Generator	NV1890011991	January 7, 1993	Indefinite	State of Nevada
Production Well (Drinking Water)				
Well 6 Production Well	NY-3014-12NC	September 2000	September 2001	State of Nevada

NOTE: TTR = Tonopah Test Range
 RCRA = Resource Conservation and Recovery Act
 "Emission units" are sources such as generators and boilers.

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Environmental Programs Information

In this Chapter ...

<i>ER Project Activities</i>	3-2
<i>Waste Management Programs</i>	3-2
<i>SPCC Plan</i>	3-6
<i>NEPA Program</i>	3-6
<i>Environmental Monitoring Performed by</i>	
<i>Outside Agencies</i>	3-6
<i>Summary of Release Reporting</i>	3-8

Chapter Summary

The Environmental Restoration (ER) Project, the Waste Management Program, and the National Environmental Policy Act (NEPA) are some of the programs and activities Sandia Corporation's Tonopah Test Range (TTR) utilizes to meet compliance with various state and federal regulations, executive orders (EOs), and U.S. Department of Energy (DOE) Orders.

In 2001, Sandia Corporation progressed with many environmental initiatives. The ER Project generated 43,116 kg of non-Resource Conservation and Recovery Act (RCRA) waste and 95 kg of RCRA waste at cleanup sites throughout TTR.

TTR is dedicated to significantly reducing the amount of chemical and hazardous wastes generated on-site, which includes recycling and recovery of various materials, such as solvents, fuels, and oil.

Environmental Snapshot



- *In 2001, Sandia Corporation sent 86 self luminous exit signs that contained tritium back to the manufacturer for recycling due to service life expiration.*

TTR's Waste Management Program is managed by Westinghouse Government Service and handles the following waste categories: radioactive waste, RCRA-hazardous waste, other chemical waste, and non-hazardous solid waste.



Wild Horses at TTR

Environmental programs at Sandia Corporation's TTR are in place to meet compliance with state and federal regulations, EOs, and DOE Orders. Programs and activities discussed in this chapter include the ER Project, the Waste Management Program, NEPA compliance activities, and environmental monitoring by outside agencies. Terrestrial surveillance, drinking water, wastewater, and air quality programs are discussed in Chapter 4 of this report.

3.1 ER PROJECT ACTIVITIES

The ER Project at TTR began in 1980 to address contamination resulting primarily from nuclear weapons testing and related support activities. In late 1992 and early 1993, an agreement was reached between DOE Headquarters (HQ), the DOE, Albuquerque Operations Office (AL), and the DOE, Nevada (NV) office regarding the management of ER activities at TTR. The decision was made to designate the responsibility of all ER sites to DOE/NV.

Since 1996, cleanup activities for sites located in the State of Nevada have been regulated by the Federal Facility Agreement and Consent Order (FFACO) (DoD/DOE/State of NV 1996). The FFACO was negotiated between DOE/NV, the Nevada Division of Environmental Protection (NDEP), and the U.S. Department of Defense (DoD). The FFACO took effect on May 10, 1996 and accomplished the following:

- Established a framework for identifying Corrective Action Sites (CASs),
 - Grouped CASs into Corrective Action Units (CAUs),
 - Prioritized CAUs, and
 - Implemented corrective action activities.
- The FFACO is also discussed in Section 2.3. CAUs located at TTR are addressed by two ER Division Projects:
- (1) **Industrial Sites Project** – Past sites used to support nuclear testing activities, and
 - (2) **Soil Sites Project** – Areas where tests resulted in extensive surface and/or shallow subsurface contamination.

ER site contamination includes radiological (e.g., depleted uranium [DU] and plutonium) and non-radiological constituents (e.g., artillery, solvents, septic sludges, and heavy metals).

CAS Identification

The initial identification, description, and listing of CASs at TTR were derived from the Preliminary Assessment (PA) and the *Federal Facility Preliminary Assessment Review* (E&E 1989). In 1993, the potential TTR CASs identified in the PA were subdivided into four "Soil Sites CAUs" and 43 "Industrial Sites CAUs." Twelve additional potential CASs not included in the PA were also identified. These CASs were identified through:

- ER sites inventory process,
- Ordnance removal activities,
- Geophysical surveys,
- Former worker interviews,
- Archive reviews,
- Site visits, and
- Aerial radiological and multispectral surveys (1993 to 1996).

The remediation activities at the Clean Slate and Double Tracks sites (Project Roller Coaster) are discussed in Chapter 1. These sites are listed under Soil Sites CAUs/CASs in Table 3-1 as CAU-411, -412, -413, and -414.

Table 3-1 summarizes the existing Industrial and Soil Sites CAUs and CASs at TTR. The ER activities planned for these CASs range from "no activities currently planned" to "NDEP-approved closure." The CAS information presented in Table 3-1 is contained in Appendices II, III, and IV of the FFACO (DoD/DOE/State of NV 1996).

2001 ER Activities

In 2001, cleanup at ER sites generated a total of 43,116 kg of primarily (non-RCRA waste) and 95 kg of RCRA waste. A total of 37,415 kg of ER waste was shipped off-site. RCRA waste included rinsate, personal protective equipment (PPE), sampling debris, and field-testing kits. All RCRA-hazardous waste is shipped off-site to permitted treatment, storage, and disposal (TSD) facilities. Construction debris is disposed of at the U.S. Air Force (USAF) sanitary landfill. No low-level waste (LLW) was generated by ER activities in 2001. Westinghouse Government Service participates in environmental cleanup and restoration activities.

3.2 WASTE MANAGEMENT PROGRAMS

All waste generated by Sandia Corporation activities at TTR is managed by Westinghouse Government Service under the Waste Management Program. (Sandia Corporation does not handle waste generated by ER activities.) Waste

TABLE 3-1. DOE/NNSA/NV ER Project TTR CAUs and CASs Calendar Year 2001 Status

Industrial Sites CAUs/CASs		
CAS Number	CAS Description	General Location
CAU-400 - Closed		
Bomblet Pit and Five Points Landfill, TTR		
TA-19-001-05PT	Ordnance Disposal Pit	Five Points Intersection
TA-55-001-TAB2	Ordnance Disposal Pit	Bunker 2 Road
CAU-401 - Closed		
Area 3 Gas Station UST Site, TTR		
03-02-003-0357	UST, Gas	First Gas Station, Area 3
CAU-402 - Closed		
Area 3 Bldg. 0353 UST Site, TTR		
03-02-001-0353	UST, Diesel	Bldg. 0353
CAU-403 - Closed		
Area 3 Second Gas Station UST, TTR		
03-02-004-0360	USTs	Second Gas Station
CAU-404 - Closed		
Roller Coaster Lagoons and Trench, TTR		
TA-03-001-TARC	Roller Coaster Lagoons	NW of Antelope Lake
TA-21-001-TARC	Roller Coaster North Disposal Trench	NW of Antelope Lake
CAU-405 - Remediation Phase		
Area 3 Septic Systems, TTR		
03-05-002-SW03	Septic Waste System	Area 3
03-05-002-SW04	Septic Waste System	Area 3
03-05-002-SW07	Septic Waste System	Area 3
CAU-406 - Closed		
Area 3 Bldg. 03-74 and Bldg. 03-58 UDPs, TTR		
03-51-002-0374	Heavy Duty Shop UDP, Sumps	Bldg. 0374
03-51-003-0358	UPS Building UDP	UPS Building, Area 3
CAU-407 - Remediation Phase		
Roller Coaster Rad Safe Area, TTR		
TA-23-001-TARC	Roller Coaster Rad Safe Area	Northwest of Antelope Lake
CAU-408 - Not Started		
Bomblet Target Area, TTR		
TA-55-002-TAB2	Bomblet Target Areas	Antelope Lake
CAU-409 - Closed		
Other Waste Sites, TTR		
RG-24-001-RGCR	Battery Dump Site	Cactus Repeater
TA-53-001-TAB2	Septic Sludge Disposal Pit	Bunker 2
TA-53-002-TAB2	Septic Sludge Disposal Pit	Bunker 2
CAU-410 - Characterization Phase		
Area 9 Underground Vault and Disposal Trench, TTR		
09-21-001-09MG	Former Bunker or Underground Vault	East of Area 9 Magazines
09-21-001-TA09	Disposal Trenches	Area 9
TA-19-002-TAB2	Debris Mound	Bunker 2
TA-21-003-TANL	Disposal Trench	NEDS Lake
TA-21-002-TAAL	Disposal Trench	South Antelope Lake

Refer to notes at end of table.

TABLE 3-1. DOE/NNSA/NV ER Project TTR CAUs and CASs Calendar Year 2001 Status (*continued*)

Industrial Sites CAUs/CASs		
CAS Number	CAS Description	General Location
CAU-423 – Closed		
Area 3 UDP, Bldg. 0360, TTR		
03-02-002-0308	UDP	Bldg. 0360
03-02-002-0308	UDP	Bldg. 0360
CAU-424 - Closed		
Area 3 Landfill Complex, TTR		
03-08-001-A301	Landfill Cell A3-1	Area 3 Landfill Complex
03-08-002-A302	Landfill Cell A3-2	Area 3 Landfill Complex
03-08-002-A303	Landfill Cell A3-3	Area 3 Landfill Complex
03-08-002-A304	Landfill Cell A3-4	Area 3 Landfill Complex
03-08-002-A305	Landfill Cell A3-5	Area 3 Landfill Complex
03-08-002-A306	Landfill Cell A3-6	Area 3 Landfill Complex
03-08-002-A307	Landfill Cell A3-7	Area 3 Landfill Complex
03-08-002-A308	Landfill Cell A3-8	Area 3 Landfill Complex
CAU-425 – Remediation Phase		
Area 9 Main Lake Construction Debris Disposal Area, TTR		
09-08-001-TA09	Construction Debris Disposal Area	Area 9/Main Lake
CAU-426 - Closed		
Cactus Spring Waste Trenches, TTR		
RG-08-001-RGCS	Waste Trenches	Cactus Spring Ranch
CAU-427 - Closed		
Area 3 Septic Waste Systems 2 and 6, TTR		
03-05-002-SW02	Septic Waste System No. 2	Area 3
03-05-002-SW06	Septic Waste System No. 6	Area 3
CAU-428 - Closed		
Area 3 Septic Waste Systems 1 and 5, TTR		
03-05-002-SW01	Septic Waste System No. 1	Area 3
03-05-002-SW05	Septic Waste System No. 5	Area 3
CAU-429 - Closed		
Area 3 Bldg. 03-55 and Area 9 Bldg. 09-52 UDPs, TTR		
03-51-001-0355	Photo Shop UDPs, Drains	Photo Shop Area 3
09-51-001-0952	Mobile Photographic Lab UDPs	Area 9
CAU-430 - Closed		
DU Artillery Round #1, TTR		
TA-55-003-0960	DU Artillery Round	South of Area 9
CAU-453 - Closed		
Area 9 UXO Landfill, TTR		
09-55-001-0952	Area 9 Landfill	Area 9
CAU-461 - Closed		
Test Area JTA Sites, TTR		
TA-52-002-TAML	DU Impact Site	Main Lake
TA-52-003-0960	DU Artillery Round #2	South of Area 9
TTR-001	1987 W-79 JTA	Unknown – South of Area 9
CAU-484 –		

TABLE 3-1. DOE/NNSA/NV ER Project TTR CAUs and CASs Calendar Year 2001 (*concluded*)

Industrial Sites CAUs/CASs		
CAS Number	CAS Description	General Location
CAU-485 - Closed		
Cactus Spring Ranch Pu and DU Site, TTR		
TA-39-001-TAGR	Cactus Spring Ranch, Soil Contamination	West of Target Areas
CAU-486 - Closed		
Double Tracks Rad Safe Area, Nellis Range 71 North		
71-23-001-71DT	Double Tracks Rad Safe Area	Nellis Range 71 North
CAU-487 - Closed		
Thunderwell Site, TTR		
RG-26-001-RGRV	Thunderwell Site	Thunderwell Site
CAU-489 - Not Started		
WWII UXO Sites, TTR		
RG-55-001-RGMN	WWII Ordnance Site	Mellan Airstrip
RG-55-002-RGHS	WWII Ordnance Site	H-Site Road
RG-55-003-RG36	WWII Ordnance Site	Gate 36E
CAU-490 - Remediation Phase		
Station 44 Burn Area, TTR		
RG-56-001-RGBA	Fire Training Area	Station 44
03-56-001-03BA	Fire Training Area	Area 3
03-58-001-03FN	Sandia Service Yard	Area 3
09-54-001-09L2	Solid Propellant Burn Site	Area 9
CAU-495 - Closed		
Unconfirmed JTA Sites, TTR		
TA-55-006-09SE	Buried Artillery Round	Test Area
TA-55-007-09SE	Buried Artillery Round	Test Area
CAU-496 - Not Started		
Buried Rocket Site – Antelope Lake, TTR		
TA-55-008-TAAL	Buried Rocket	Antelope Lake
CAU-499 - Remediation Phase		
Hydrocarbon Spill Site, TTR		
RG-25-001-RD24	Hydrocarbon Spill Site	Radar 24 Site
Soil Sites CAUs/CASs:		
CAU-411 - Closed		
Double Tracks Plutonium Dispersion, Nellis		
NAFR-23-01	Pu-contaminated Soil	Double Tracks
CAU-412 - Closed		
Clean Slate 1 Plutonium Dispersion, TTR		
TA-23-01CS	Pu-Contaminated Soil	Clean Slate 1
CAU-413 - Remediation Phase		
Clean Slate 2 Plutonium Dispersion, TTR		
TA-23-02CS	Pu-Contaminated Soil	Clean Slate 2
CAU-414 - Not Started		
Clean Slate 3 Plutonium Dispersion, TTR		
TA-23-03CS	Pu-Contaminated Soil	Clean Slate 3

SOURCE: DoD/DOE/State of NV 1996 and ongoing updates

NOTE: DOE = U.S. Department of Energy
 CAU = Corrective Action Unit
 CAS = Corrective Action Site
 DU = depleted uranium
 ER = Environmental Restoration
 NEDS = Non-Explosive Destruction Site

NNSA = National Nuclear Security Administration
 NV = Nevada office
 UDP = underground discharge points
 UST = underground storage tank
 UXO = unexploded ordnance

categories include radioactive waste, RCRA-hazardous waste, other chemical waste, and non-hazardous solid waste. Waste minimization and recycling efforts are integrated into Waste Management Program activities. Westinghouse Government Service has 14 Occupational Safety and Health Administration (OSHA) 40-hour Hazwoper certified personnel.

Waste generated and handled by Sandia Corporation at TTR in 2001 was as follows:

<u>Waste Type</u>	<u>Weight</u>
RCRA waste	1,304 kg
Non-hazardous or recycled chemical waste	8,107 kg
Radioactive waste - exit signs for recycle (Tritium)	83 kg

Sandia Corporation shipped all regulated waste to off-site permitted TSD facilities.

Table 3-2 shows a detailed breakdown of the RCRA waste categories and quantities. Table 3-3 lists regulated non-RCRA waste categories and quantities. Table 3-4 lists waste categories transported off-site for recycling or alternative fuel use. A *Hazardous Waste Biennial Report* is prepared by SNL/NM and submitted to the U.S. Environmental Protection Agency (EPA) through DOE/NNSA/NV (SNL 2002b).

Waste Minimization Program

TTR is committed to achieving significant reductions in the amount of chemical and hazardous wastes generated on-site. Waste minimization includes recycling and recovery of the following materials:

- Solvents,
- Fuels and oil,
- Antifreeze (on-site recycling unit),
- Lead acid batteries,
- Freon (on-site recovery unit),
- Fluorescent and sodium bulbs, and
- Mercury-containing equipment.

Radioactive Waste Management

Sandia Corporation sent 86 self-luminous exit signs containing tritium back to the manufacturer for recycling, due to service life expiration. Non-radioactive replacement signs were used; however, radioactive waste was generated by remediation of ER sites under the cognizance of DOE/NNSA/NV.

3.3 SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC) PLAN

The *SPCC Plan for SNL Tonopah Test Range* (SNL 1999), which was revised in 1999, pertains to oil storage equipment and secondary containments subject to 40 CFR 112, "Oil Pollution Prevention" and 40 CFR 110, "Discharge of Oil."

There are three aboveground storage tanks (ASTs), two Bulk Storage Areas (BSA), and one transformer storage area that are regulated with a capacity of greater than 660 gallons that are applicable to the SPCC Plan at TTR.

3.4 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) PROGRAM

NEPA Activities at TTR

At TTR, NEPA compliance is a coordinated process by Sandia Corporation at TTR, Sandia Corporation at Sandia National Laboratories, New Mexico (SNL/NM), and DOE/National Nuclear Security Administration (NNSA), Office of Kirtland Site Operations (OKSO). Additionally, under the direction of Sandia Corporation, compliance is supported by the Water Resources Center at the Desert Research Institute (DRI) through the University of Nevada System. DRI prepares archaeological and biological surveys and reports. Final reports are submitted to Sandia Corporation for transmittal to DOE/NNSA/OKSO for review and decision-making and consultation with state and federal agencies.

The Final Environmental Impact Statement (EIS) for the Nevada Test Site and Off-Site Locations in the State of Nevada, which includes the TTR site, was completed in 1996; the DOE Record of Decision (ROD) was filed on December 9, 1996 (DOE 1996b).

3.5 ENVIRONMENTAL MONITORING PERFORMED BY OUTSIDE AGENCIES

In addition to Sandia Corporation, other agencies perform environmental monitoring activities at TTR, as described below.

EPA

The EPA Environmental Monitoring Systems Laboratory in Las Vegas, NV, monitored background radiation in the area of TTR as part of its Off-site Radiation Monitoring Reports

TABLE 3-2. Sandia Corporation TTR Generated RCRA-Regulated Hazardous Waste Shipped Off-site in 2001

Waste Description	Waste Codes	Generated (kg)
WASTE MANAGEMENT		
NOS, Petroleum distillates (petroleum naptha)	D001	236
NOS, (rags with methylene chloride)	F002, F003, F005, D035	298
NOS, Corrosive liquid, basic, inorganic (photographic developer)	D002	48
NOS, Corrosive liquid, Acidic, organic (photographic developer)	D002, D011	118
NOS, Flammable liquids (Lab Pack)	D001	2
NOS, Flammable liquids (Lab Pack)	D001, D008	58
Vapor bulbs (mercury)	D009, D002	2
Aerosols flammable (petroleum distillates)	D001	94
Waste Compressed Gases, Flammable	D001	26
Ni-Cad Batteries	D006	40
Waste Hypochlorite Solution (Bleach)	D002	6
Cadmium Contaminated Soil	D006	290
Hazardous Waste Solid, NOS (Respirator Cartridges)	D007	110
Waste Epinephrin	P042	2
TOTAL		1,304
ENVIRONMENTAL RESTORATION (ER)		
NOS, hazardous liquid, (rinsate)	F003	27
NOS, hazardous solid, (soil, PPE, sampling debris from ER work)	F003	68
TOTAL		95

NOTE: NOS = not otherwise specified
kg= kilograms

PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act

TABLE 3-3. Non-RCRA-Regulated Hazardous or Toxic Waste Shipped Off-site in 2001

Waste Description	Generated (kg)
WASTE MANAGEMENT	
Waste Compressed Gases (Empty)	12
Used (large) alkaline batteries	528
Incandescent light bulbs	28
Oil contaminated rags	268
Separator pit clean-out	686
Used Oil filters	358
Oil filled capacitor (non-PCB)	2
Waste Fire Extinguishers	76
Empty 5 gallon Oil cans	35
Compressors with oil	84
Corrosive Solids (drager tubes)	6
TOTAL	2,083
ENVIRONMENTAL RESTORATION (ER)	
hydrocarbon impacted soil and debris	1,834
Asbestos-containing material (ACM)	41
benzo(a)pyrene impacted soil	1,185
arsenic impacted soil	7,110
sanitary/construction debris, compactable trash, and PPE	5,734
TPH impacted septage	21,416
TOTAL	37,320

NOTE: kg = kilogram
PCB = polychlorinated biphenyls
TPH = total petroleum hydrocarbon

PPE = personal protective equipment
RCRA = Resource Conservation and
Recovery Act

TABLE 3-4. Recycled Regulated Hazardous or Toxic Waste Shipped Off-site in 2001

Recycled Material or Energy Recovered Material	Generated (kg)
WASTE MANAGEMENT	
Circuit Boards	48
Lead Vibration dampers	204
Sodium Bulbs (High Pressure)	18
Automotive Grease	26
Used Oil	5,160
Lead Acid Batteries	342
Fluorescent Bulbs	216
Diesel Fuel	10
TOTAL	6,024
ENVIRONMENTAL RESTORATION (ER)	
ER waste	0
TOTAL	0

NOTE: kg = kilogram

Program (EPA 1999), which is now being done by DRI.

DRI, University of Nevada System

The DRI trains and provides monitoring station managers (generally they are local science teachers) to run the EPA monitoring equipment set up at locations within the local community including the towns of Tonopah and Goldfield. The EPA laboratory in Las Vegas, Nevada provides the equipment and performs the analysis and reporting.

DRI also provides external quality assurance (QA) on field measurements taken by the EPA at these community-monitoring stations. DRI monitors selected locations concurrently using a portable monitoring station (PMS) and thermoluminescent dosimeters (TLDs). DRI's *Community Radiation Monitoring Program Annual Report* now appears as part of the Nevada Test Site Annual Site Environmental Report (ASER) (DOE 2001).

DRI also performs other monitoring—primarily hydrological—for the DOE, as requested. This may include evaluating environmental impacts due to construction projects at TTR.

Westinghouse Government Service

As part of its TTR support activities, Westinghouse Government Service personnel perform environmental monitoring activities for DOE and/or Sandia Corporation when needed as follows:

- Drinking water and wastewater sampling;
- National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61, Subpart H (radionuclides) air quality monitoring;

- Soil sampling and site characterization of spill sites;
- Waste sampling and characterization; and
- ER support activities.

3.6 SUMMARY OF RELEASE REPORTING

The following three release reporting documents must be submitted to external regulatory agencies if releases exceed applicable threshold quantities (TQ):

- *NESHAP Annual Report for CY 2001*, SNL/NV (SNL 2002), requires that an annual report be submitted from each DOE/NNSA site where facility sources contribute a public dose of over 0.1 mrem/yr. The NESHAP report must be submitted to the EPA by June 30th each year, following the reporting year. The report includes the calculated effective dose equivalent (EDE) in mrem/yr for the maximally exposed individual (MEI). Chapter 4 of this report summarizes results of the NESHAP dose assessment results for TTR.
- *State of Nevada Reports* – The State of Nevada requires copies of each hazardous waste manifest that accompanies each waste shipment.
- *State of Nevada Extremely Hazardous Material Reporting Requirements* – This is not currently required since Sandia Corporation does not use any extremely hazardous materials during its routine operations.

Environmental Monitoring

In this Chapter ...

<i>Terrestrial Surveillance</i>	4-2
<i>Water Monitoring</i>	4-6
<i>Radiological Air Monitoring</i>	4-8
<i>Non-radiological Air Emissions</i>	4-9

Chapter Summary

Terrestrial surveillance is conducted at the Tonopah Test Range (TTR) to detect the possible migration of contaminants to off-site locations and to determine the potential impact of Sandia Corporation's operations on human health or the environment.

Sandia Corporation monitors drinking water supplies at TTR to ensure that the State of Nevada drinking water regulations are met. Wastewater sampling is conducted annually to ensure that Sandia Corporation's releases to the sanitary sewer system meet the requirements of the National Pollution Discharge Elimination System (NPDES), maintained by the U.S. Air Force (USAF). Septic systems are sampled, as needed.

Environmental monitoring and surveillance is conducted under the direction of the Environmental Management (EM) Department at Sandia National Laboratories, New Mexico (SNL/NM). Westinghouse Government Service, the on-site contractor at TTR, performed or

Environmental Snapshot



- *In 2001, total non-radiological air emissions reported to the State of Nevada were 0.001 tons per year from the TTR screening plant.*

assisted in most environmental monitoring activities in 2001. These included production Well 6 sampling, wastewater sampling, ambient air monitoring, soil sampling at spill sites, managing the thermoluminescent dosimeter (TLD) network, and hazardous waste characterization.

TTR adheres to specific air quality compliance permit conditions and complies with local, state, and federal air regulations. Ambient air monitoring is currently not required at TTR, but was last conducted in 1996.



View From Antelope Peak

4.1 TERRESTRIAL SURVEILLANCE

4.1.1 Program Objectives

The objectives of the Terrestrial Surveillance Program can be summarized by the following excerpts of the requirements given in U.S. Department of Energy (DOE) Order 5400.1, *General Environmental Protection Program* (DOE 1990):

- Collect and analyze samples to characterize environmental conditions and define increasing or decreasing trends.
- Establish background levels of pollutants to define baseline conditions (off-site sampling).
- Provide continuing assessment of pollution abatement programs.
- Identify and quantify new or existing environmental quality problems and their potential impacts, if any.
- Verify compliance with applicable environmental laws and regulations and commitments made in National Environmental Policy Act (NEPA) documents, such as Environmental Impact Statements (EISs), as well as other official documents.

4.1.2 Regulatory Standards and Comparisons

The Terrestrial Surveillance Program is designed and conducted in accordance with the requirements of DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990). Concentration limits for radionuclides and metals in terrestrial media are not well defined; however, the EM Department does compare the results from on-site and perimeter locations to community (off-site) results to determine the impact, if any, of Sandia Corporation's operations on the environment.

4.1.3 Statistical Analyses

Samples are generally collected from fixed locations to effectively make statistical comparisons with results from previous years. Statistical analyses are performed to determine if a specific result or group of on-site or perimeter results, differs from off-site values, and to identify trends at a specific sampling location. Since multiple data points are necessary to provide an accurate view of a system, the Terrestrial Surveillance Program does not rely on the results

from any single year's sampling event to characterize on-site environmental conditions. Results from a single sampling point may vary from year to year, due to slight changes in sampling locations, differences in climatic conditions, and laboratory variations or errors. Therefore, as the amount of data increases, the accuracy of the characterization increases.

The results of the statistical analyses allow the EM Department to prioritize sample locations for possible follow-up action. The prioritization process is a decision-making tool to assist in determining the appropriate level of concern for each sample result. The Statistical Analysis Prioritization Method (Shyr, Herrera, and Haaker, 1998) is based on two "yes or no" questions resulting in a matrix of four priority levels. The matrix is shown in Table 4-1.

To date, there have been no terrestrial sample results that have indicated a significant level of concern (Priority-1) that would trigger actions at locations that are not already being addressed by the Environmental Restoration (ER) Project.

In past years, the period of time covered by the statistical analysis was from 1994 to present. In CY 2001, the analysis was limited to a five-year period (this year beginning in 1997). The reason for the change was that SNL/NM changed analytical laboratories in CY 2000, with lower detection capabilities for many of the metals and radiological analyses. As a result, a large number of false decreasing trends were noted for many of the parameters when the whole data set was analyzed. By limiting the analysis to a five-year period, the number of apparent decreasing trends was reduced, and should be eliminated over the next couple of years.

Non-radiological soil analyses are scheduled to occur every other year (during even numbered years). Non-radiological analyses were not performed in CY 2001; therefore, no results or statistical analyses are included in this report.

4.1.4 Sampling Locations

Terrestrial surveillance began at TTR in 1992. In addition to routine sampling, a large-scale baseline sampling was performed in 1994 in areas where Sandia Corporation had a long-term or continued presence.

Routine terrestrial surveillance is conducted at on-site, perimeter, and off-site locations that remain essentially the same from year to year. Sample

TABLE 4-1. Decision Matrix for Determining Priority Action Levels

Priority	Are results higher than off-site?*	Is there an increasing trend ?	Priority for further investigation
1	Yes	Yes	Immediate attention needed. Specific investigation planned and/or notifications made to responsible parties.
2	Yes	No	Some concern based on the level of contaminant present. Further investigation and/or notifications as necessary.
3	No	Yes	A minor concern since contaminants present are not higher than off-site averages. Further investigation and/or notifications as necessary.
4	No	No	No concern. No investigation required.

NOTE: Based on Statistical Analysis Prioritization Methodology (Shyr, Herrera, and Haaker 1998).

*While some sites may appear higher than off-site, there may not be a statistically significant difference.

locations may be modified as necessary to reflect current operations or to supplement data from existing locations. For example, prior to 2000, locations T-20 and T-21 were used to monitor around an area contaminated with DU. That site has been remediated and the sampling locations were disturbed. Location T-21 was deleted from the Terrestrial Surveillance Program and, due to remediation efforts, T-20 was moved a short distance from the original sampling location.

The sampling locations, number of samples, and analyses performed are prioritized based on the following criteria:

- **On-site locations** are near areas of known contamination, potential sources of contamination, or in areas where contamination, if present, would be expected to accumulate, such as in the vicinity of ER sites. A list of on-site sampling locations is shown in Table 4-2. Appendix B, Figures B-3, B-4a, B-4b, B-5a, B-5b, and B-5c contain maps of the sampling locations. A total of 21 locations were sampled on-site.
- **Community (Off-site) locations** are selected to provide a measurement of environmental conditions unaffected by Sandia Corporation's activities at TTR. Data collected from off-site locations serve as a reference point to compare data collected at perimeter and on-site locations. Multiple years of sampling data are compiled to determine statistical

averages for off-site concentrations. Off-site locations are chosen both in remote, natural settings as well as in areas near local population centers and along highways. Table 4-3 contains a list of the off-site sample locations. The 14 off-site locations sampled are shown in Figure B-1 of Appendix B.

- **Perimeter locations** are selected to establish if contaminants are migrating either onto or off Sandia Corporation property at TTR. A list of perimeter sampling locations is shown in Table 4-4. A map of the eight perimeter locations is shown in Figure B-2 of Appendix B. All perimeter locations are in areas to which Sandia Corporation does not control access within TTR.

4.1.5 Radiological Parameters and Results

Soil is the only terrestrial medium sampled at the TTR. There are no bodies of water, other than the Playa lakes (dry lake beds with only occasional standing water), and vegetation is scarce. Soil samples are collected to ascertain the presence of air-deposited pollutants or contaminants that have been transported and deposited as a result of surface water runoff. Samples are collected from the top two inches of soil using a hand trowel. The CY 2001 analytical results are found in Appendix B of this report. The detailed statistical analyses are documented in the *Tonopah Test Range Data Analysis in Support of the Annual Site Environmental Report, 2001* (SNL 2002a).

TABLE 4-2. On-site Terrestrial Surveillance Locations at TTR

Location Number	Sample Location	Replicate* Location
South Plume		
T-14	N/S Mellan Airstrip – Antelope Tuff	Yes
T-16	N/S Mellan Airstrip – SW of T-14	--
T-17	N/S Mellan Airstrip – sign post	--
T-18	N/S Mellan Airstrip – NE of T-17	--
T-19	NE of NW/SE Mellan Airstrip	--
Range Operations Center		
OC-02	Waste Water Monitoring Station	--
OC-03	“Danger Powerline Crossing” Sign	--
OC-04	Main Road/Edward’s Freeway	--
OC-10	SW Corner of Sandia Corporation, TTR Operations Center	--
OC-13	NE Corner of Sandia Corporation, TTR Operations Center	--
OC-19	Storage Shelters, 03-38/03-39	--
OC-22	Sand Building	--
OC-23	Generator Storage Area	--
Various On-site Locations		
D-01	Roller Coaster Decon	Yes
MH-03	Mellan Hill – Metal Scrap Pile	--
MH-04	Mellan Hill – North	--
T-02	N/S Mellan Airstrip (TLD at south fence post)	--
T-03	TLD at Clean Slate 2	Yes
T-04	TLD at Clean Slate 3	--
T-10	Brownes Road/Denton Freeway	--
T-20	Main Road/Lake Road SE	--

NOTE: TLD = thermoluminescent dosimeter

TTR = Tonopah Test Range

-- = There is not a replicate location for this sample location

* In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.

TABLE 4-3. Off-site Terrestrial Surveillance Locations at TTR

Location Number	Sample Location	Replicate* Location
B-01	Alkali/Silver Peak Turnoff	--
B-02	Cattle Guard	--
B-03	Tonopah Ranger Station	--
B-04	State Road 6/95 Rest Area	--
B-05	Gabbs Pole Line Road	--
B-06	State Roads 6/376 Junction	--
B-07	Rocket	--
B-08	State Road 6 Rest Area	--
B-09	Stone Cabin/Willow Creek	--
B-10	State Roads 6 and 375 Junction	--
B-11	State Road 375 Ranch Cattle Gate	--
B-12	Golden Arrow/Silver Bow	--
B-13	Five miles south of Rocket	--
B-14	Nine miles south of Rocket	--

NOTE: TTR = Tonopah Test Range

-- = There is not a replicate location for this sample location

* In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.

TABLE 4-4. Perimeter Terrestrial Surveillance Locations at TTR

Location Number	Sample Location	Replicate* Location
OM-03	O&M Complex (Owan Drive post)	--
T-06	Cedar Pass Road Guard Station	--
T-08	On-Base Housing (Main guard gate/power pole CP17)	--
T-11	Cactus Springs (north fence post)	--
T-12	TLD at "US Gov't Property" Sign	--
T-13	Cactus Springs (TLD south of T-11)	--
T-36	On-Base Housing (NE fence line)	--
T-37	On-Base Housing (guard station)	--

NOTE: TLD = thermoluminescent dosimeter

TTR = Tonopah Test Range

O&M = Operations & Maintenance

-- = There is not a replicate location for this sample location

* In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.

- Gamma-emitting radionuclides** – gamma spectroscopy is used to detect the emission of gamma radiation from radioactive materials. Radionuclide identification is possible by measuring the spectrum of gamma energies associated with a sample, since each radionuclide has a unique and consistent series of gamma emissions. Cesium-137 (Cs-137) is an example of a long-lived gamma emitter that is prevalent in the environment (as fallout from historical nuclear weapons testing). Other gamma-emitters of interest at TTR are Americium-241 (Am-241) and DU from past explosives testing.
- Plutonium** – Due to past explosive testing, plutonium is present in some areas of TTR. One of the indicators of the presence of weapons-grade plutonium is the radionuclide Am-241. Isotopic plutonium analysis is normally performed on any sample for which gamma spectroscopy identified Am-241 in concentrations greater than its minimum detectable activity (MDA).
- Uranium** – Uranium occurs naturally in soils and may also be present as a pollutant in the environment due to past testing conducted at TTR. Total uranium (U_{tot}) analysis is used to measure all uranium isotopes present in a sample. A high U_{tot} measurement may trigger an isotope-specific analysis to determine the possible source of uranium (i.e., natural, man-made, enriched, or depleted).

For CY 2001 sample period, isotopic plutonium analyses were performed on all samples submitted to the analytical laboratory. This is not the usual procedure; but since the data were available, the sample results are reported in Appendix B as Plutonium-238 (Pu-238) and Plutonium 239/240 (Pu-239/240).

Radiological Results

The results of the statistical analysis showed no on-site or perimeter location that were both higher than off-site and with an increasing trend (Priority-1). Two locations were identified as Priority-2 (higher than off-site). Priority-2 locations along with the associated parameters are listed in Table 4-5. There were no on-site or perimeter locations identified as Priority-3 (increasing trend). As in years past, there were also several locations identified with a decreasing trend.

Am-241

One on-site location (D-01) was identified as Priority-2 (higher than off-site) for Am-241. The highest value observed for this location was 3.58 pCi/g in 2000. If the maximum value is deleted, the other values range from 0.51 - 0.72 pCi/g.

Pu-239/240

One on-site location (D-01) was identified as Priority-2 (higher than off-site) for Pu-239/240. This location was also noted as having a decreasing trend for Pu-239/240 concentrations. The highest recorded value was noted in 1997 at 6.5 pCi/g and has been decreasing every year since with the minimum value recorded in 2001. Results at this location range from 2.77 pCi/g to 6.5 pCi/g.

TLD Results

Sampling for 2001 was conducted from January 8, 2001 through January 9, 2002. Table 4-6 shows the summary statistics by location type from 1997 to 2001. On-site and perimeter locations are statistically indistinguishable from off-site locations. There does appear to be a significant difference between years with 1999 being the highest recorded year and 2001 being the lowest recorded year, but all other years are statistically about the same. Figure 4-1 graphically portrays the TLD results

from 1997 to 2001. TLD results and TLD measurements by quarter and location type for 2001 are shown in Tables B-8 and B-9 of Appendix B, respectively.

4.1.6 Non-Radiological Parameters and Results

TTR Soil samples are analyzed for 20 Inductively Coupled Plasma (ICP-20) stable metals plus mercury every other year (during even numbered years). In CY 2001, non-radiological analyses were not performed. Special sampling occurred in Area 9 at the request of the Industrial Hygiene Program. Results for this special sampling event are listed in Appendix B, Table B-7. No statistical analyses were performed on this data, but a qualitative comparison shows reasonable consistency with historical results.

4.2 WATER MONITORING

Results for potable water, wastewater effluent sampling, and the issue of storm water monitoring are discussed in this section.

The *Water Conservation Plan for the Tonopah Test Range* complies with State Water Resources Division regulations requiring a water conservation plan for permitted water systems and major water users in Nevada (DOE 1992).

4.2.1 Production Well Monitoring

There are three active wells used by Sandia Corporation at TTR. Production Well 6, Well 7, and the Roller Coaster Well. Production Well 6 and the Roller Coaster Well are the most active. Production Well 6, which supplies drinking water to the Sandia Corporation Main Compound in Area 3, is the only well that has been sampled for contaminants.

Outlying areas use bottled water. The other wells are not used for potable purposes (construction and dust suppression) and there is no regulatory sampling requirement. Sampling at the two non-potable wells has not been required or requested by DOE/National Nuclear Security Administration (NNSA) or SNL/NM.

TABLE 4-5. Summary Statistics for Soil Locations Noted as Priority-2 for Am-241
(All units in pCi/g)

Analyte	Location	Sample Size	Average	Std Dev	Minimum	Maximum
Am-241	D-01	5	1.21	1.33	0.51	3.58
Pu-239/240	D-01	5	4.53	1.74	2.77	6.50

NOTE: pCi/g = picocurie per gram
Std Dev = Standard Deviation

TABLE 4-6. Summary of TLD Measurements for 1997 to 2001

Location Class	No. Of Obs	Units	Mean	Std Dev	Minimum	Maximum
On-Site	22	mrem/yr	147.81	14.22	125.4	218.3
Perimeter	17	mrem/yr	142.46	16.26	100.0	175.4
Off-Site	63	mrem/yr	140.77	14.99	105.1	164.3

NOTE: mrem/yr = millirem per year
Std Dev = Standard Deviation
Obs = observations
TLD = Thermoluminescent dosimeter

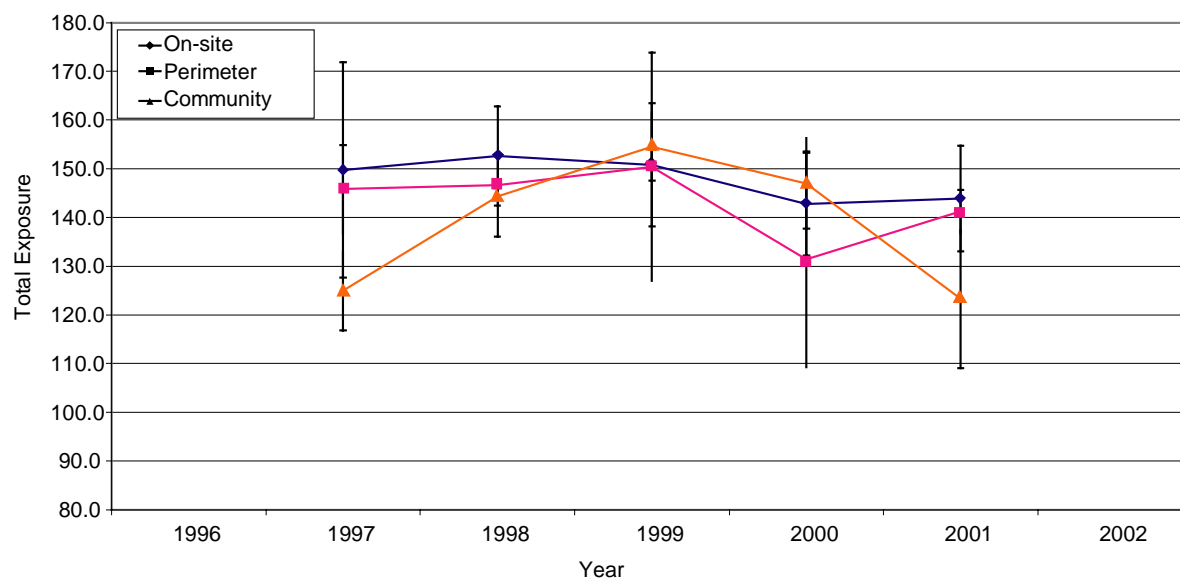


FIGURE 4-1. Tonopah Test Range TLD Exposure (1997-2001)

All sampling is conducted in accordance with requirements set by the state (State of Nevada 1997). Analytes are sampled at different intervals as follows:

Analyte	Sampling frequency
Total Coliform	monthly
Nitrates and nitrites	annually
Dioxins	last sampled in 1999
VOCs and SVOCs	last sampled in 1999
Copper and lead*	last sampled in 1999

NOTE: *Sampling is due in 2002

VOC = Volatile organic compounds

SVOC = Semi-volatile organic compounds

A complete chemical and radiological analysis of drinking water for the Nevada Test Site (NTS) is required by the State of Nevada every three years; this was last performed on April 8, 1999. Sampled parameters included, but were not limited to, nitrates, nitrites, VOCs, lead, copper, and arsenic.

Parallel Sampling by the U.S. Environmental Protection Agency (EPA)

The EPA also performs sampling on Production Well 6 for nitrate and nitrites every three years. In addition, the EPA provides a radiological analysis survey for the Long-Term Hydrologic Monitoring Program. Sampling sites are based on state specified locations (State of Nevada 1997) and are

in accordance with the Safe Drinking Water Act (SDWA).

4.2.2 Sewage System and Septic Tank Monitoring

Sewage System

Sewage from Sandia Corporation's facilities in the Main Compound at Area 3 goes to the USAF facultative sewage lagoon. Westinghouse Government Service takes annual wastewater samples from Area 3 at the point wastewater leaves Sandia Corporation property and enters the USAF system.

The USAF holds the NPDES permit for its wastewater discharges. The USAF takes quarterly samples from the headwater end of the lagoon. In the past, Sandia Corporation provided quarterly sampling results to the USAF for inclusion into their USAF Discharge Monitoring Report (DMR); however, the NPDES permit was modified in 1997 and no longer stipulates the requirement of quarterly data from Sandia Corporation. Therefore, Sandia Corporation now only provides annual sample results to the USAF.

Westinghouse Government Service collects 48-hour composite wastewater samples on an annual basis and has the following parameters analyzed:

- Total cyanide (Sandia Corporation does not use cyanide-containing compounds at TTR);

- pH (potential of hydrogen [acidity]) and non-filtered residue;
- Phenolics (Sandia Corporation does not use phenol-containing compounds at TTR);
- Chemical oxygen demand (COD);
- VOCs;
- SVOCs;
- Metals (cadmium, chromium, copper, nickel, silver, zinc, lead, selenium, and mercury);
- Total recoverable petroleum hydrocarbons (TRPH);
- Oil and grease; and
- Tritium, gamma spectroscopy, gross alpha, and gross beta.

All analytical results for wastewater sampled at Area 3 were within regulatory limits in 2001. Analytical results can be obtained from Westinghouse Government Service.

Septic Tank Systems

Septic tank systems are sampled, as needed. There are six septic systems located on-site, which are owned by Sandia Corporation at TTR. These six active septic tanks are used in remote locations and are maintained by the TTR facilities group. The sewage from these locations flows into septic tanks and associated drain fields. None of these systems required maintenance, sampling, or pumping in 2001. All other remaining septic systems have been closed or are undergoing closure and are being addressed by the ER Project.

4.2.3 Storm Water Monitoring

Currently, Sandia Corporation has no requirement to perform storm water monitoring at TTR. All storm water issues and monitoring are managed by the USAF.

4.3 RADIOLOGICAL AIR MONITORING

Air quality compliance at the TTR is met by adherence to specific permit conditions and compliance with local, state, and federal air regulations. Ambient air quality monitoring is not

currently required at TTR. Ambient air monitoring was last conducted in 1996 to ascertain the level of radiological constituents in the air as discussed below.

Operations by Sandia Corporation at TTR do not involve activities that release radioactive emissions from either point sources (stacks and vents) or diffuse sources such as outdoor testing. However, diffuse radiological emissions are produced from the re-suspension of americium and plutonium present at the Clean Slate ER sites. Other ER sites with minor radiological contamination, such as DU, do not produce significant air emission sources from re-suspension.

National Emission Standards for Hazardous Air Pollutants (NESHAP)

NESHAP, 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities," has set a maximum of 10 mrem/yr for all combined air emission pathway sources from any DOE/NNSA facility. Although the dose calculated from the Clean Slate sites is many times less than this standard, there was a question of whether the site would require continuous radiological air monitoring.

The 1995 NESHAP report for TTR reported a calculated effective dose equivalent (EDE) to the maximally exposed individual (MEI) of 1.1 mrem/yr as a result of diffuse emissions from the Clean Slate sites (SNL 1996). Because the EPA requires continuous air monitoring for any radionuclide source that contributes a dose in excess of 0.1 mrem/yr to the MEI, Sandia Corporation instituted continuous air monitoring at the site for one year, from February 22, 1996 to February 25, 1997. The monitoring site was chosen at the TTR Airport, the location of the highest calculated dose for a member of the public. This site selection is discussed in the 1996 NESHAP report (SNL 1997). The dose assessment result from the continuous monitoring was 0.024 mrem/yr. This was about four times less than the 0.1 mrem/yr threshold cutoff for which continuous monitoring would be required by the EPA. The average air concentration in curies per cubic meter (Ci/m³) were measured as follows:

Am-241	4.1 x 10 ⁻¹⁸ Ci/m ³
Pu-238	1.6 x 10 ⁻¹⁸ Ci/m ³
Pu-239/240	9.5 x 10 ⁻¹⁹ Ci/m ³

Although an annual calculated dose assessment is not required for the site, Sandia Corporation continues to produce an annual NESHAP report for TTR (SNL 2002). The results from the 1996 to 1997 monitoring will continue to be used for as long as there is no change in the status of the Clean Slate sites. Table 4-7 summarizes these dose assessment results. Future TTR activities are not expected to change. However, if new sources or modifications to the existing sources are anticipated, they will be evaluated for NESHAP applicability.

4.4 NON-RADIOLOGICAL AIR EMISSIONS

The TTR Class II Air Quality Operating Permit Renewal in 2001 exempted most emission sources used at TTR with the exception of the screening plant and portable screen. In 2001, the total emissions reported to the State of Nevada were 0.001 tons per yr from the screening plant.

TABLE 4-7. Calculated Dose Assessment Results for On-site Receptor

Dose to Receptor	Location	1997 Measured Dose*	NESHAP Standard	Natural Background
On-site Receptor (EDE to the MEI)	Airport TTR Area	0.024 mrem/yr (0.00024 mSv/yr)	10 mrem/yr (0.1 mSv/yr)	250 ¹

NOTE: *Dose calculated from continuous monitoring February 1996 to February 1997.

EDE = effective dose equivalent

MEI = maximally exposed individual

mSv/yr = millisievert per year

TTR = Tonopah Test Range

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Chapter 5

References

In this Chapter ...

<i>References</i>	5-1
<i>Act and Statutes</i>	5-4
<i>Executive Orders</i>	5-5
<i>DOE Orders</i>	5-5
<i>Code of Federal Regulations</i>	5-5

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- Brookins 1992** Brookins, D., “Background Radiation in the Albuquerque, New Mexico, U.S.A., Area,” in *Environmental Geology and Water Science*, Vol. 19, No. 1, pp. 11-15 (1992).
- DOC 2002** U.S. Department of Commerce, U.S. Census Bureau website at <<http://www.census.gov/>> (2002).
- DoD/DOE/
State of NV
1996** U.S. Department of Defense, U.S. Department of Energy, and Nevada Department of Conservation and Natural Resources, *Federal Facility Agreement and Consent Order* (FFACO). State of Nevada Department of Conservation and Natural Resources Division of Environmental Protection and the U.S. DOE and the U.S. DoD in the Matter of Federal Facility Agreement and Consent Order (March 15, 1996). Available on the Web at: <http://ndep.state.nv.us/boff/agree.htm>
- DOE 2001** U.S. Department of Energy, *Nevada Test Site Annual Site Environmental Report for CY 2000*, DOE/NV 11708-605. Prepared by Bechtel for the U.S. DOE/NNSA/NVOO. (Ch.5, “Radiological Environmental Programs”) Las Vegas NV (2001).
- DOE 2001a** DOE Order 435.1 (See DOE Orders Section).
- DOE 2000** DOE Manual 231.1-1 (See DOE Orders Section).
- DOE 2000a** DOE Order 470.2A. (See DOE Orders Section).
- DOE 2000b** DOE Order 451.1B. (See DOE Orders Section).
- DOE 1996a** DOE Order 231.1 (See DOE Orders Section).
- DOE 1996b** U.S. Department of Energy, *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*, DOE/EIS 0243. DOE, Nevada Operations Office, Las Vegas, NV (August 1996).
- DOE 1994** U.S. Department of Energy, *Memorandum of Agreement Between the Nevada Operations Office and the Albuquerque Operations Office*, DE-GM08-98NV13555 (Appendix C, *Tonopah Test Range*, signed October 1997). U.S. Department of Energy, Albuquerque, NM and Las Vegas, NV (1994).
- DOE 1993** DOE Order 5400.5 (See DOE Orders Section).
- DOE 1993a** DOE Order 5400.2A. (See DOE Orders Section).
- DOE 1992** U.S. Department of Energy, *Water Conservation Plan for the Tonopah Test Range*, 4809. U.S. Department of Energy/Nevada Operations Office, Las Vegas, NV (1992).
- DOE 1990** DOE Order 5400.1 (See DOE Orders Section).
- DRI 1997** Desert Research Institute (DRI), *Draft Analysis of Ambient Airborne Particulate Matter for Plutonium; Clean Slate 1 During Excavation and Truck Loading, Tonopah Test Range, May 1997 - June 1997*, DRI Document Number 6357-683-7562.1D1. Prepared by DRI for the U.S. Department of Energy/ Nevada Field Office, Las Vegas, NV (November 14, 1997).

- DRI 1991** Desert Research Institute, *Special Nevada Report*, DOE/NV/10715-T1. Prepared by Science Applications International Corporation (SAIC) for the Department of the Air Force (September 23, 1991).
- Dunaway and White, 1974** Dunaway, P.B. and M.G. White, *The Dynamics of Plutonium in Desert Environments, Nevada Applied Ecology Group Progress Report*, NVO-142. U.S. Atomic Energy Commission, Nevada Operations Office, Las Vegas, NV (1974).
- E&E 1989** Ecology and Environment, Inc., *Federal Facility Preliminary Assessment Review*, EPA Region IX, F9-8903-021, NV3570090016. Ecology and Environment, Inc., San Francisco, CA (1989).
- EG&G 1979a** Edgerton, Germeshausen & Grier Corporation, *Status of Endangered and Threatened Plant Species on Tonopah Test Range - A Survey*, EGG-1183-2387. EG&G, Las Vegas, NV (1979).
- EG&G 1979** Edgerton, Germeshausen & Grier Corporation, *Status of Endangered and Threatened Plant Species on Tonopah Test Range - A Survey*, EGG-1183-2387. EG&G, Las Vegas, NV (1979).
- EG&G 1995** Edgerton, Germeshausen & Grier Corporation, *Aerial Radiological Survey of the Tonopah Test Range Including Clean Slate 1, 2, 3, Roller Coaster, Decontamination Area, Cactus Springs Ranch Target Areas, Central Nevada*, EGG-11265-1145. EG&G Energy Measurements, Inc., Las Vegas, NV (1995).
- EPA 2002** U.S. Environmental Protection Agency, "National Priorities List (NPL) Sites in the United States," available on the Web at <http://www.epa.gov/superfund/sites/npl/npl.htm>. U.S. Environmental Protection Agency, Washington, D.C. (2002).
- EPA 1999** U.S. Environmental Protection Agency, *Off-site Environmental Monitoring Report: Radiation Monitoring Around United States Nuclear Test Areas, Calendar Year 1997*, EPA/402-R-98-013, U.S. Environmental Protection Agency, Las Vegas, NV (1999).
- ERDA 1975** U.S. Energy Research and Development Administration, *Environmental Assessment, Tonopah Test Range*, EIA/MA/76-2. ERDA (1975).
- Essington and Fowler 1976** Essington, E. H., and E. B. Fowler, "Distribution of Transuranic Nuclides in Soils," a review in *Transuranics in Natural Environments*, Report NVO-178. U.S. Energy Research and Development Administration, Las Vegas, NV (1976).
- Gilbert et al. 1975** Gilbert, R. O., et al., "Statistical Analysis of ²³⁹⁻²⁴⁰Pu and ²⁴¹Am Contamination of Soil and Vegetation on NAEG Study Sites," in *The Radioecology of Plutonium and Other Transuranics in Desert Environments*, Report NVO-153. U.S. Energy Research and Development Administration, Las Vegas, NV (1975).
- Gore 1993** Gore, Al., *From Red Tape to Results: Creating a Government that Works Better and Costs Less*, Report if the National Performance Review. U.S. Government Printing Office, Washington, D.C. (1993).
- IT 1996** IT Corporation, *Sampling and Analysis Plan for Clean Slate 1*. IT Corporation (September 1996).
- IT 1993** IT Corporation, *Analytical Results for Tonopah Test Range, Transformer Oil Samples, Collected July 16-18, 1993*. IT Corporation, Albuquerque, NM (September 1993).
- Kabata-Pendias and Pendias, 1992** Kabata-Pendias and Pendias, 1992, *Trace Elements in Soils and Plants*, 2nd. Ed. CRC Press, Inc., Boca Raton, Florida (1992).
- Leavitt 1980** Leavitt, V., *Soil Profiles of Mounds on Plutonium-Contaminated Areas of the Nevada Test Range Complex*. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Las Vegas, NV (1980).

- Leavitt 1976** Leavitt, V., "Soil Surveys of Five Plutonium-Contaminated Areas on the Test Range Complex in Nevada," in *Nevada Applied Ecology Group Procedures Handbook for Environmental Transuranics*, Report NVO-166, Volume 1. National Environmental Research Center, Las Vegas, NV (1976).
- Romney et al. 1975** Romney, E. M., et al., "²³⁹⁻²⁴⁰Pu and ²⁴¹Am Contamination of Vegetation in Aged Plutonium Fallout Areas," in *The Radioecology of Plutonium and Other Transuranics in Desert Environments*, Report NVO-153. U.S. Energy Research and Development Administration, Las Vegas, NV (1975).
- Schaeffer 1970** Schaeffer, J. R., *Climatology of Tonopah Test Range, Nevada 1961-1969*, SC-TM-70-0215. Sandia National Laboratories, Albuquerque, NM (1970).
- Shyr, Herrera, Haaker 1998** Shyr, L.J., H. Herrera, R. Haaker, *The Role of Data Analysis in Sampling Design of Environmental Monitoring*, SAND98-0612. Sandia National Laboratories, Albuquerque, NM (March 1998).
- Sinnock 1982** Sinnock, S., *Geology of the Nevada Test Site and Nearby Areas - Southern Nevada*, SAND82-2207. Sandia National Laboratories, Albuquerque, NM (1982).
- SNL 2002** Sandia National Laboratories, *NESHAP Annual Report for CY 2001*, Sandia National Laboratories, Nevada, internal doc # 75-1021-6. Sandia National Laboratories, Albuquerque, NM (June 2002).
- SNL 2002a** Sandia National Laboratories, *Tonopah Test Range Data Analysis in Support of the Annual Site Environmental Report, 2001*. Sandia National Laboratories, Albuquerque, NM (July 2002).
- SNL 2002b** Sandia National Laboratories, *2001 Hazardous Waste Biennial Report for Sandia National Laboratories/New Mexico and Sandia National Laboratories/Tonopah Test Range*, Sandia National Laboratories, Albuquerque, New Mexico (March 2002).
- SNL 1999** Sandia National Laboratories, *Spill Prevention Control and Countermeasures (SPCC) Plan for SNL Tonopah Test Range*, Plan 90-12, Rev. 4. Sandia National Laboratories, Albuquerque, NM (October 1999).
- SNL 1997** Sandia National Laboratories, (1) *NESHAP Annual Report for CY 1996* (EPA Summary) and (2) *Radiological Dose Calculations and Supplemental Dose Assessment Data for NESHAP Compliance for Sandia National Laboratories, Nevada, CY 1996*. Sandia National Laboratories, Albuquerque, NM (1997).
- SNL 1996** Sandia National Laboratories, (1) *NESHAP Annual Report for CY 1995* (EPA Summary) and (2) *Radiological Dose Calculations and Supplemental Dose Assessment Data for NESHAP Compliance for Sandia National Laboratories, Nevada, CY 1995*. Sandia National Laboratories, Albuquerque, NM (1996).
- SNL 1993** Culp, T. and Howard, D., *1992 Environmental Monitoring Report, Tonopah Test Range, Tonopah, Nevada*, SAND 93-1449. Sandia National Laboratories, Albuquerque, NM (1993).
- State of Nevada 1997** State of Nevada, *State of Nevada Bureau of Health Protection Services Vulnerability Assessment Contamination Monitoring Waiver*. State of Nevada, (Sampling protocols for water quality, expiration date 2010) (October 21, 1997).
- Tamura 1977** Tamura, T., "Plutonium Distribution in a Desert Pavement - Desert Mound Soil System in Area 11," in *Environmental Plutonium on the Nevada Test Site and Environs*, Report NVO-171. U.S. Energy Research and Development Administration, Las Vegas, NV (1977).
- Tamura 1976** Tamura, T., "Plutonium Association in Soils," in *Transuranics in Natural Environments*, Report NVO-178. U.S. Energy Research and Development Administration, Las Vegas, NV (1976).

- Tamura 1975** Tamura, T., "Characterization of Plutonium in Surface Soils from Area 13 of the Nevada Test Site," in *The Radioecology of Plutonium and Other Transuranics in Desert Environments*, Report NVO-153. U.S. Energy Research and Development Administration, Las Vegas, NV (1975).
- USAF 1978** United States Air Force, *Final Environmental Impact Statement, Proposed Public Land Withdrawal, Nellis Air Force Bombing Range: Nye, Clark, and Lincoln Counties, Nevada*. Department of the Air Force, Washington, DC (1978).
- WRCC 2002** Western Regional Climate Center website: <http://www.wrcc.dri.edu/cemp/> (2002).

EXECUTIVE ORDERS

- EO 11990** *Protection of Wetlands* (May 24, 1977).
- EO 11988** *Floodplain Management* (May 24, 1977).
- EO 12898** *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended (February 11, 1994).
- EO 13148** *Greening the Government Through Leadership in Environmental Management* (April 21, 2000).

DOE ORDERS

- DOE 2001a** U.S. Department of Energy, *Radioactive Waste Management*, DOE Order 435.1, Change 1. U.S. Department of Energy, Washington, DC (August 28, 2001).
- DOE 2000** U.S. Department of Energy, *Environment, Safety, and Health Reporting Manual*, DOE Manual 231.1-1, Change 2. U.S. Department of Energy, Washington, D.C. (January 28, 2000).
- DOE 2000a** U.S. Department of Energy, *Security and Emergency Management Independent Oversight and Performance Assurance Program*, DOE Order 470.2A. U.S. Department of Energy, Washington, D.C. (March 1, 2000).
- DOE 2000b** U.S. Department of Energy, *National Environmental Policy Act Compliance Program*, DOE Order 451.1B. U.S. Department of Energy, Washington, DC (October 26, 2000).
- DOE 1996a** U.S. Department of Energy, *Environment, Safety, and Health Reporting*, DOE Order 231.1, Change 2. U.S. Department of Energy, Washington, DC (November 7, 1996).
- DOE 1993** U.S. Department of Energy, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5. U.S. Department of Energy, Washington, DC (January 7, 1993).
- DOE 1993a** DOE Order 5400.2A. U.S. Department of Energy, *Environmental Compliance Issue Coordination*, AL 5400.2A U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM (July 13, 1993).
- DOE 1990** U.S. Department of Energy, *General Environmental Protection Program*, DOE Order 5400.1, Change 1. DOE, Washington, DC (June 29, 1990).

CODE OF FEDERAL REGULATIONS

- 10 CFR 1021** “National Environmental Policy Act Implementing Procedures”
- 40 CFR 61** “National Emission Standards for Hazardous Air Pollutants (NESHAP)”
- 40 CFR 110** “Discharge of Oil”
- 40 CFR 112** “Oil Pollution Prevention”
- 40 CFR 141.26** “Monitoring Frequency for Radioactivity in Community Water Systems”
- 40 CFR 270** “EPA Administered Permit Programs: The Hazardous Waste Permit Program”
- 40 CFR 280** “Technical Standards and Corrective Action Requirements for Owners and Operations of Underground Storage Tanks”

ACTS AND STATUTES

- American Indian Religious Freedom Act (AIRFA) of 1978 (42 U.S.C. § 1996)
- Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. § 470aa)
- Atomic Energy Act (AEA) of 1954 (42 U.S.C. § 2011 et seq.)
- Clean Air Act (CAA) and CAA Amendments (CAAA) of 1990 (42 U.S.C. § 7401)
- Clean Water Act (CWA) of 1977 (the Federal Water Pollution Control Act)
(33 U.S.C. § 1251)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980
(42 U.S.C. § 9601) Amended by the Superfund Amendments and Reauthorization Act (SARA)
- Emergency Planning and Community Right to Know Act (EPCRA) of 1986 (42 U.S.C. § 11001 et seq.) (Also known as SARA Title III.)
- Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.)
- Federal Facility Compliance Act (FFCA) of 1992 (42 U.S.C. § 6961)
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. § 136).
- Migratory Bird Treaty Act (MBTA) of 1918 (U.S.C. § 703 et seq.)
- National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. § 4321).
- National Historic Preservation Act of 1966 (16 U.S.C. § 470).
- Pollution Prevention Act of 1990 (42 U.S.C. § 13101 et seq.)
- Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S.C. § 6901 et seq.)
- Safe Drinking Water Act (SDWA) (42 U.S.C. § 300f).
- Superfund Amendments and Reauthorization Act (SARA) of 1986 (see CERCLA)
- Toxic Substances Control Act (TSCA) of 1976 (15 U.S.C. § 2601 et seq.).

NOTE: U.S.C = United States Code

APPENDIX A

STATE OF NEVADA ENVIRONMENTAL REGULATIONS

Nevada regulatory information can be found at the Nevada State Legislature website:
<http://www.leg.state.nv.us/>

A listing of the Nevada Administrative Code (NAC) can be found at:
<http://www.leg.state.nv.us/NAC/Index.htm>

TABLE A-1. State of Nevada Administrative Code (NAC) Applicable to the Tonopah Test Range (TTR)

Chapter 444, Sanitation	Applicable Sources or Activities
NAC 444.570 to 444.7499, "Solid Waste Disposal"	<ul style="list-style-type: none"> • Disposal of construction debris • Disposal of routine non-hazardous solid wastes • Disposal of septic sludge
NAC 444A.005 to 444A.470, "Programs for Recycling"	<ul style="list-style-type: none"> • Recyclable materials including waste tires
Chapter 445A, Water Controls	
NAC 445A.070 to 445A.348, "Water Pollution Control"	<ul style="list-style-type: none"> • Septic tanks • Surface water runoff
NAC 445A.450 to 445A. 6731, "Public Water Systems"	<ul style="list-style-type: none"> • Production well sampling
Chapter 445B, Air Controls	
NAC 445B.001 to 445B.3485, "Air Pollution"	<ul style="list-style-type: none"> • Open burning • Hazardous air pollutants from stacks and vents • Disturbance of soils during construction (particulate matter)
NAC 445B.400 to 445B.774, "Emissions From Engines"	<ul style="list-style-type: none"> • Generators • Mobile sources
Chapter 504, Wildlife Mangement and Propagation*	
NAC 504.110 to 504.340, "Wildlife Management Areas" NAC 504.510 to 504.550, "Alteration of Stream System or Watershed"	<ul style="list-style-type: none"> • Road construction • Construction activities
NAC 504.800 to 504.865, "Preservation of Wild Horses"***	<ul style="list-style-type: none"> • General activities on the range in wild horse areas
Chapter 534, Underground Water and Wells	
NAC 534.010 to 534.450, "Underground Water and Wells"	<ul style="list-style-type: none"> • Drilling, operation, and abandonment of wells

NOTE: *This law provides protection to endangered, threatened, and sensitive species.

**Two wild horse units encompass areas within the Nellis Air Force Range:

"Unit 252: That portion of Nye County and those portions of the Nellis Air Force Range as authorized by the United States Department of Defense."

"Unit 253: That portion of Nye County ... including those portions of the Nellis Air Force Range as authorized by the United States Department of Defense and the Nevada Test Site as authorized by the United States Department of Energy."

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APPENDIX B

**TERRESTRIAL SURVEILLANCE RESULTS
AND
SAMPLING LOCATION MAPS**



Target Lake at Tonopah Test Range (1960s)

CONTENTS

FIGURES

B-1	Off-site Soil Sampling Locations (14 Locations).....	B-4
B-2	Perimeter Soil Sampling Locations (Eight Locations).....	B-7
B-3	Soil Sampling Locations in the South Plume Area (Five locations).....	B-9
B-4a	Soil Sampling Locations in the Range Operations Center and Compound (Six locations).....	B-12
B-4b	Soil Sampling Locations Around the Range Operations Center Storage Yard (Two locations)	B-13
B-5a	Various On-site Soil Sampling Locations (Five locations).....	B-16
B-5b	Various Soil Sampling Locations at Mellan Hill Area (Two locations)	B-17
B-5c	Various Soil Sampling Locations Near the Hard Target/Depleted Uranium Area (Two locations)	B-18

TABLES

B-1	Radiological Results for Off-site Soil Sampling Locations, 2001.....	B-1
B-2	Radiological Results for Perimeter Soil Sampling Locations, 2001.....	B-5
B-3	Radiological Results for South Plume Area Soil Sampling Locations, 2001	B-8
B-4	Radiological Results for Range Operations Center Soil Sampling Locations, 2001	B-10
B-5	Radiological Results for Various On-site Soil Sampling Locations, 2001	B-14
B-6	Radiological Replicate Sampling for Soil Sampling Locations, 2001	B-19
B-7	Non-radiological Results for Soil Sampling Locations in Area 9, 2001	B-22
B-8	Summary TLD Results for Calendar Year 2001, Tonopah Test Range	B-24
B-9	TLD Measurements by Quarter and Location Class for Calendar Year 2001.....	B-25

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TABLE B-1. Radiological Results for Off-site Soil Sampling Locations, 2001

Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
B-01	Americium-241	pCi/g	0.00832 ± 0.031	0.0122	0.0562	U
	Cesium-137	pCi/g	0.224 ± 0.0492	0.00702	0.0394	
	Plutonium-238	pCi/g	0.00785 ± 0.0112	0.011	0.00857	U
	Plutonium-239/240	pCi/g	0.0112 ± 0.00903	0.00792	0.00622	
	Uranium-235	pCi/g	0.112 ± 0.189	0.0424	0.202	U
	Uranium-238	pCi/g	2.5 ± 0.852	0.165	0.535	
	Uranium	mg/kg	0.463	0.0017	0.0396	
B-02	Americium-241	pCi/g	0.0523 ± 0.137	0.0274	0.232	U
	Cesium-137	pCi/g	0.171 ± 0.0373	0.00775	0.0365	
	Plutonium-238	pCi/g	-0.00103 ± 0.00686	0.00979	0.00697	U
	Plutonium-239/240	pCi/g	0.00723 ± 0.00552	0.00673	0.0028	
	Uranium-235	pCi/g	0.204 ± 0.183	0.0487	0.238	U
	Uranium-238	pCi/g	2.96 ± 1.89	0.329	1.72	
	Uranium	mg/kg	0.838	0.0017	0.0396	
B-03	Americium-241	pCi/g	0.0648 ± 0.0882	0.0261	0.168	U
	Cesium-137	pCi/g	0.00236 ± 0.0232	0.00886	0.0419	U
	Plutonium-238	pCi/g	0 ± 0.0819	0.0105	0.00844	U
	Plutonium-239/240	pCi/g	-0.00095 ± 0.00503	0.00731	0.0057	U
	Uranium-235	pCi/g	0.0539 ± 0.133	0.0552	0.237	U
	Uranium-238	pCi/g	2.12 ± 1.4	0.325	1.35	
	Uranium	mg/kg	0.864	0.0017	0.0395	
B-04	Americium-241	pCi/g	0.0237 ± 0.0342	0.0138	0.0626	U
	Cesium-137	pCi/g	0.217 ± 0.048	0.008	0.0412	
	Plutonium-238	pCi/g	-0.00221 ± 0.00825	0.0107	0.00812	U
	Plutonium-239/240	pCi/g	-0.0011 ± 0.00794	0.0086	0.00777	U
	Uranium-235	pCi/g	0.144 ± 0.198	0.0482	0.221	U
	Uranium-238	pCi/g	1.81 ± 0.835	0.188	0.596	
	Uranium	mg/kg	0.507	0.0017	0.0394	
B-05	Americium-241	pCi/g	0.000199 ± 0.0402	0.0142	0.0717	U
	Cesium-137	pCi/g	0.482 ± 0.0815	0.00822	0.045	
	Plutonium-238	pCi/g	0.00771 ± 0.011	0.0108	0.00842	U
	Plutonium-239/240	pCi/g	0.0319 ± 0.0131	0.00756	0.00554	
	Uranium-235	pCi/g	0.269 ± 0.236	0.0496	0.259	
	Uranium-238	pCi/g	1.98 ± 0.955	0.193	0.682	
	Uranium	mg/kg	0.865	0.0017	0.0394	

See notes at end of table.

TABLE B-1. Radiological Results for Off-site Soil Sampling Locations, 2001 (continued)

Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
B-06	Americium-241	pCi/g	0.0259 ± 0.054	0.0165	0.0969	U
	Cesium-137	pCi/g	0.439 ± 0.0613	0.00564	0.0246	
	Plutonium-238	pCi/g	0.00111 ± 0.0145	0.0126	0.0114	U
	Plutonium-239/240	pCi/g	0.0255 ± 0.0122	0.00782	0.00616	
	Uranium-235	pCi/g	0.0545 ± 0.0938	0.0391	0.174	U
	Uranium-238	pCi/g	1.43 ± 0.845	0.209	0.836	
	Uranium	mg/kg	0.638	0.0017	0.0395	
B-07	Americium-241	pCi/g	-0.0662 ± 0.137	0.0263	0.229	U
	Cesium-137	pCi/g	0.135 ± 0.0366	0.0132	0.0412	
	Plutonium-238	pCi/g	0.0238 ± 0.0167	0.00617	0.0104	
	Plutonium-239/240	pCi/g	0.00856 ± 0.0103	0.00398	0.00862	U
	Uranium-235	pCi/g	0.0667 ± 0.125	0.0609	0.229	U
	Uranium-238	pCi/g	1.34 ± 1.7	0.299	1.77	U
	Uranium	mg/kg	0.542	0.0017	0.04	
B-08	Americium-241	pCi/g	-0.0453 ± 0.152	0.032	0.263	U
	Cesium-137	pCi/g	0.152 ± 0.0551	0.0156	0.0459	
	Plutonium-238	pCi/g	0.0044 ± 0.00882	0.00571	0.00959	U
	Plutonium-239/240	pCi/g	0.0158 ± 0.0102	0	0.00429	
	Uranium-235	pCi/g	-0.00486 ± 0.133	0.0707	0.246	U
	Uranium-238	pCi/g	2.16 ± 2.05	0.368	2.02	
	Uranium	mg/kg	0.613	0.0017	0.0394	
B-09	Americium-241	pCi/g	0.0507 ± 0.05	0.0146	0.0666	U
	Cesium-137	pCi/g	0.304 ± 0.0611	0.015	0.0449	
	Plutonium-238	pCi/g	0.0096 ± 0.00975	0.00478	0.00657	
	Plutonium-239/240	pCi/g	0.00872 ± 0.0116	0.00497	0.00969	U
	Uranium-235	pCi/g	0.293 ± 0.241	0.0619	0.24	
	Uranium-238	pCi/g	2.05 ± 0.741	0.189	0.634	
	Uranium	mg/kg	0.572	0.0017	0.0397	
B-10	Americium-241	pCi/g	-0.00242 ± 0.0372	0.0154	0.0659	U
	Cesium-137	pCi/g	0 ± 0.0734	0.0158	0.0479	U
	Plutonium-238	pCi/g	0.0104 ± 0.0111	0.00592	0.00829	
	Plutonium-239/240	pCi/g	0.0112 ± 0.00756	0.00217	0.0047	
	Uranium-235	pCi/g	0.185 ± 0.216	0.0651	0.244	U
	Uranium-238	pCi/g	1.91 ± 0.896	0.2	0.647	
	Uranium	mg/kg	0.981	0.0017	0.0392	

See notes at end of table.

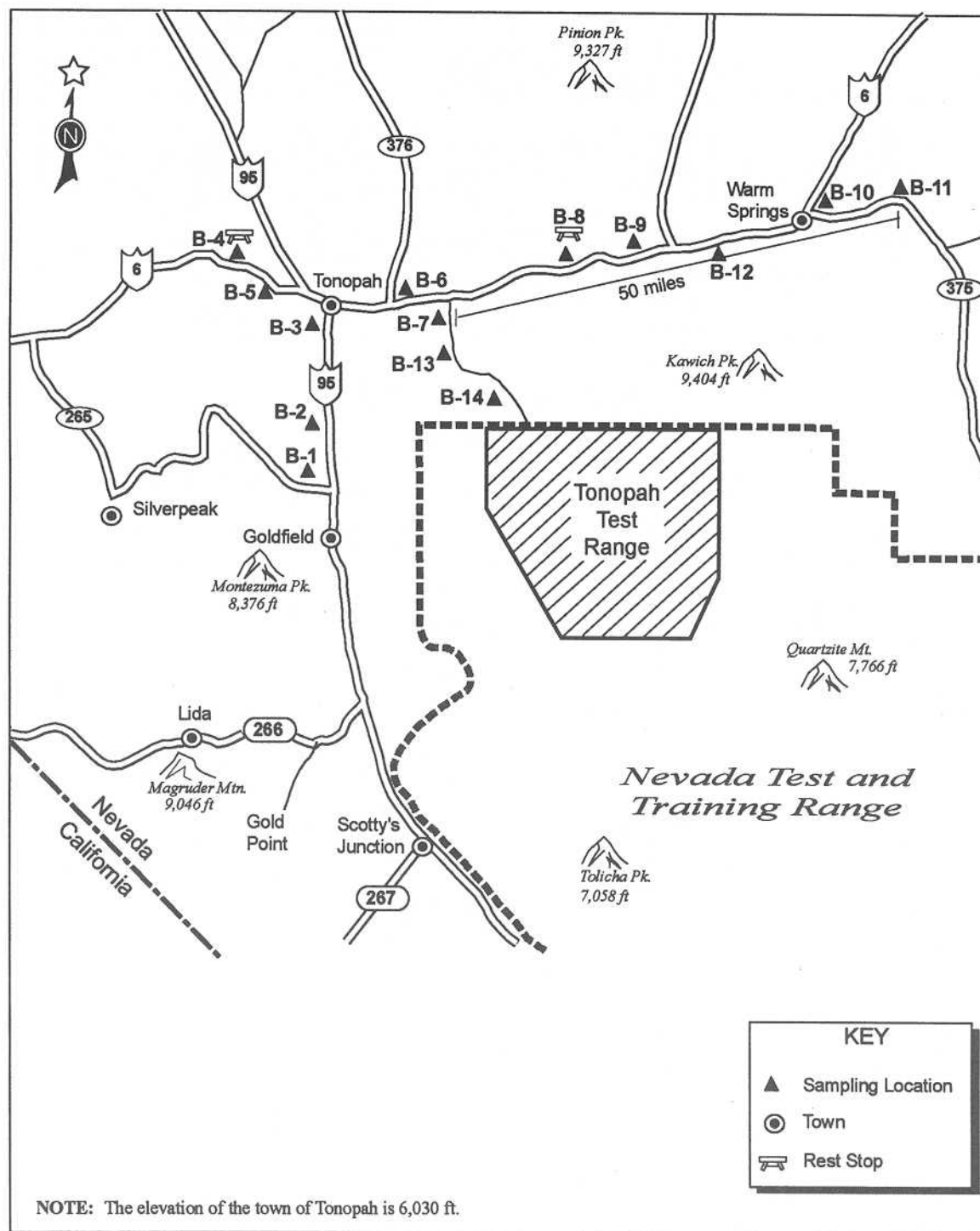
TABLE B-1. Radiological Results for Off-site Soil Sampling Locations, 2001 (*concluded*)

Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
B-11	Americium-241	pCi/g	-0.0176 ± 0.0415	0.0136	0.0824	U
	Cesium-137	pCi/g	0.238 ± 0.0373	0.00464	0.021	
	Plutonium-238	pCi/g	0.0118 ± 0.0142	0.012	0.0102	
	Plutonium-239/240	pCi/g	0.0106 ± 0.0108	0.00878	0.00792	
	Uranium-235	pCi/g	0.0835 ± 0.137	0.0322	0.151	U
	Uranium-238	pCi/g	0.641 ± 0.785	0.173	0.701	U
	Uranium	mg/kg	0.516	0.0017	0.0399	
B-12	Americium-241	pCi/g	-0.0228 ± 0.0585	0.02	0.11	U
	Cesium-137	pCi/g	0.29 ± 0.0605	0.0121	0.0292	
	Plutonium-238	pCi/g	0.00549 ± 0.00637	0.00426	0.00496	
	Plutonium-239/240	pCi/g	0.0198 ± 0.0111	0.00217	0.00574	
	Uranium-235	pCi/g	0.0888 ± 0.154	0.0574	0.198	U
	Uranium-238	pCi/g	2.21 ± 1.12	0.242	0.951	
	Uranium	mg/kg	0.701	0.0017	0.0398	
B-13	Americium-241	pCi/g	-0.044 ± 0.175	0.0294	0.215	U
	Cesium-137	pCi/g	0.154 ± 0.0497	0.0159	0.0437	
	Plutonium-238	pCi/g	0 ± 0.0897	0.00462	0.00589	U
	Plutonium-239/240	pCi/g	0.0125 ± 0.00896	0	0.00424	
	Uranium-235	pCi/g	0.141 ± 0.135	0.0725	0.252	U
	Uranium-238	pCi/g	0.979 ± 1.51	0.341	1.69	U
	Uranium	mg/kg	0.536	0.0017	0.0392	
B-14	Americium-241	pCi/g	0.0434 ± 0.0848	0.0251	0.151	U
	Cesium-137	pCi/g	0.144 ± 0.0377	0.0152	0.0409	
	Plutonium-238	pCi/g	0.00263 ± 0.00527	0.00505	0.00713	U
	Plutonium-239/240	pCi/g	0 ± 0.0943	0.00539	0.0105	U
	Uranium-235	pCi/g	0.0449 ± 0.124	0.0689	0.206	U
	Uranium-238	pCi/g	1.74 ± 1.55	0.299	1.22	
	Uranium	mg/kg	0.585	0.0017	0.0398	

NOTES: pCi/g = picocurie per gram

mg/kg = milligram per kilogram

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.



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FIGURE B-1. Off-site Soil Sampling Locations
(14 Locations)

TABLE B-2. Radiological Results for Perimeter Soil Sampling Locations, 2001

Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
OM-03	Americium-241	pCi/g	-0.0149 ± 0.0393	0.0137	0.0699	U
	Cesium-137	pCi/g	0.445 ± 0.0837	0.00794	0.0497	
	Plutonium-238	pCi/g	0.00196 ± 0.0155	0.0125	0.0115	U
	Plutonium-239/240	pCi/g	0.0431 ± 0.0146	0.00725	0.00545	
	Uranium-235	pCi/g	0.052 ± 0.205	0.0479	0.244	U
	Uranium-238	pCi/g	1.77 ± 0.866	0.187	0.688	
	Uranium	mg/kg	0.555	0.0017	0.0394	
T-06	Americium-241	pCi/g	0.00676 ± 0.0595	0.018	0.115	U
	Cesium-137	pCi/g	0.131 ± 0.031	0.00616	0.03	
	Plutonium-238	pCi/g	0.00276 ± 0.0131	0.0113	0.00989	U
	Plutonium-239/240	pCi/g	0.0202 ± 0.0103	0.00712	0.0055	
	Uranium-235	pCi/g	0.0396 ± 0.176	0.0427	0.2	U
	Uranium-238	pCi/g	1.5 ± 1.03	0.228	0.969	
	Uranium	mg/kg	0.653	0.0017	0.0396	
T-08	Americium-241	pCi/g	0.0136 ± 0.0742	0.023	0.146	U
	Cesium-137	pCi/g	0.0929 ± 0.035	0.0138	0.0403	
	Plutonium-238	pCi/g	0.00763 ± 0.00938	0.00524	0.0083	U
	Plutonium-239/240	pCi/g	0.00137 ± 0.00475	0.00226	0.00597	U
	Uranium-235	pCi/g	0.115 ± 0.114	0.0627	0.212	U
	Uranium-238	pCi/g	1.69 ± 1.36	0.27	1.18	
	Uranium	mg/kg	0.607	0.0017	0.04	
T-11	Americium-241	pCi/g	-0.123 ± 0.157	0.0328	0.265	U
	Cesium-137	pCi/g	0.12 ± 0.0422	0.0124	0.0456	
	Plutonium-238	pCi/g	0.00176 ± 0.0025	0	0.00239	U
	Plutonium-239/240	pCi/g	0.00704 ± 0.00561	0.00283	0.00383	
	Uranium-235	pCi/g	0.0216 ± 0.139	0.0638	0.256	U
	Uranium-238	pCi/g	1.97 ± 2.22	0.337	1.96	
	Uranium	mg/kg	1.11	0.0017	0.0395	
T-12	Americium-241	pCi/g	0.0349 ± 0.086	0.0237	0.167	U
	Cesium-137	pCi/g	0.403 ± 0.0789	0.011	0.0397	
	Plutonium-238	pCi/g	0.00547 ± 0.00451	0	0.00247	
	Plutonium-239/240	pCi/g	0.0164 ± 0.00832	0.00292	0.00397	
	Uranium-235	pCi/g	0.0935 ± 0.131	0.0576	0.239	U
	Uranium-238	pCi/g	1.05 ± 1.4	0.257	1.38	U
	Uranium	mg/kg	0.608	0.0017	0.0394	

See notes at end of table.

TABLE B-2. Radiological Results for Perimeter Soil Sampling Locations, 2001 (*concluded*)

Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
T-13	Americium-241	pCi/g	-0.0225 ± 0.182	0.0327	0.267	U
	Cesium-137	pCi/g	0.211 ± 0.0491	0.0108	0.0412	
	Plutonium-238	pCi/g	0.00534 ± 0.00506	0.00146	0.00387	
	Plutonium-239/240	pCi/g	0.0293 ± 0.0106	0.00242	0.00241	
	Uranium-235	pCi/g	0.0804 ± 0.118	0.0586	0.226	U
	Uranium-238	pCi/g	1.61 ± 2.13	0.338	1.98	U
	Uranium	mg/kg	0.614	0.0017	0.0399	
T-36	Americium-241	pCi/g	-0.145 ± 0.118	0.0236	0.19	U
	Cesium-137	pCi/g	0.108 ± 0.0352	0.0118	0.034	
	Plutonium-238	pCi/g	0.028 ± 0.0148	0.0043	0.00507	
	Plutonium-239/240	pCi/g	0.00538 ± 0.00662	0.00221	0.00586	U
	Uranium-235	pCi/g	0.178 ± 0.167	0.0509	0.193	U
	Uranium-238	pCi/g	1.24 ± 1.47	0.272	1.53	U
	Uranium	mg/kg	0.627	0.0017	0.0394	
T-37	Americium-241	pCi/g	0.043 ± 0.101	0.0238	0.168	U
	Cesium-137	pCi/g	0.0122 ± 0.024	0.0142	0.0371	U
	Plutonium-238	pCi/g	0.00185 ± 0.0037	0.00431	0.00501	U
	Plutonium-239/240	pCi/g	0.00798 ± 0.00657	0	0.00361	
	Uranium-235	pCi/g	0.134 ± 0.179	0.0595	0.216	U
	Uranium-238	pCi/g	0.426 ± 1.4	0.276	1.36	U
	Uranium	mg/kg	0.619	0.0017	0.04	

NOTES: pCi/g = picocurie per gram

mg/kg = milligram per kilogram

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.

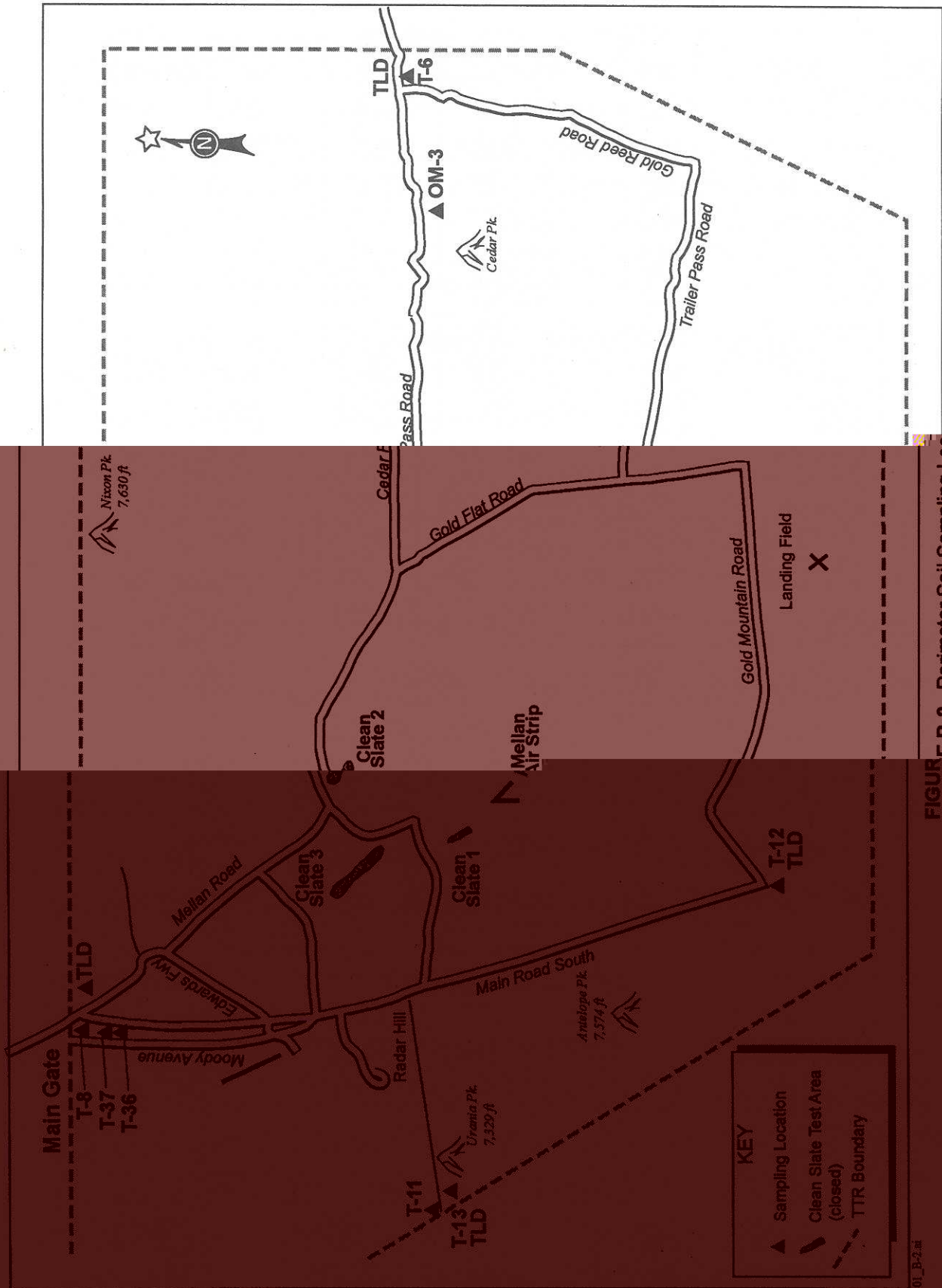


FIGURE B-2. Perimeter Soil Sampling Locations (Eight Locations)

TABLE B-3. Radiological Results for South Plume Area Soil Sampling Locations, 2001

Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
T-14	Americium-241	pCi/g	0.15 ± 0.109	0.0155	0.0852	
	Cesium-137	pCi/g	0.551 ± 0.109	0.0128	0.0545	
0.00456						

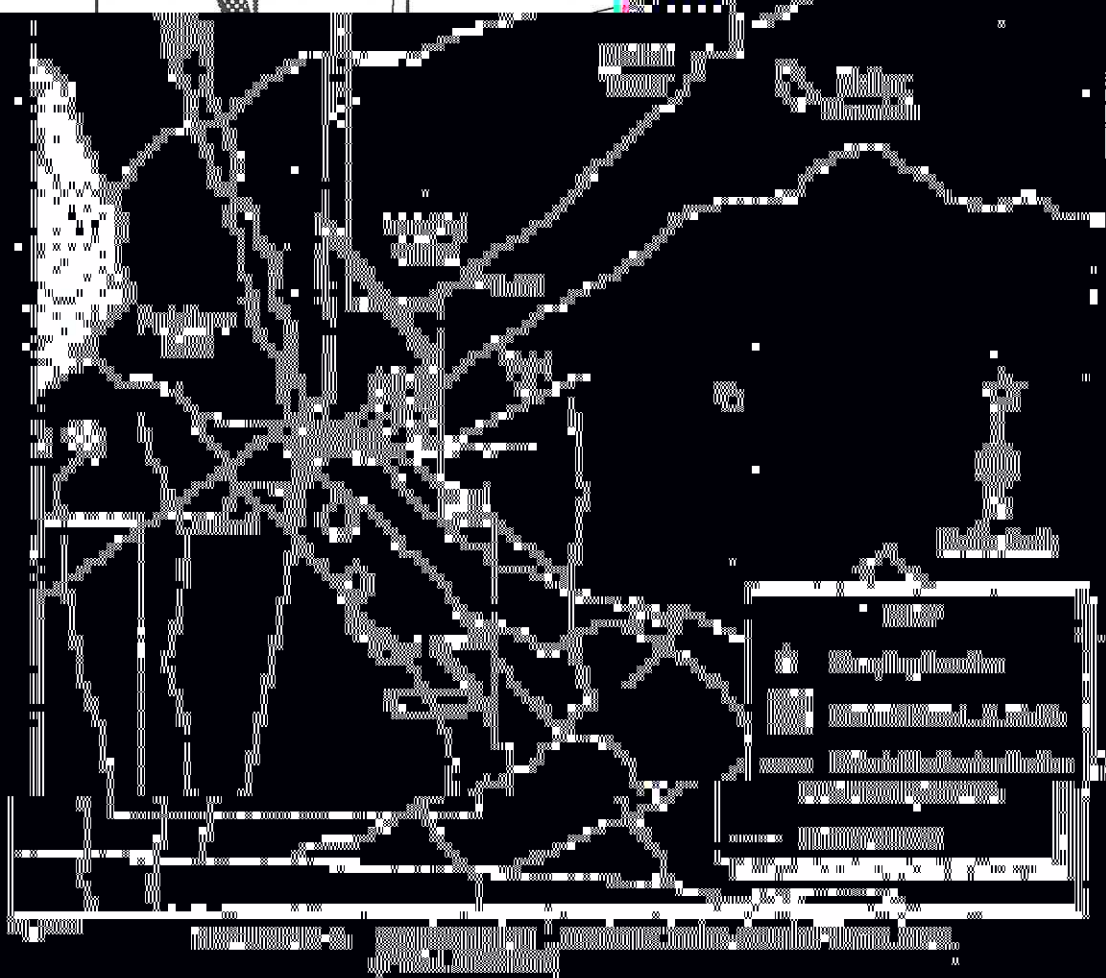
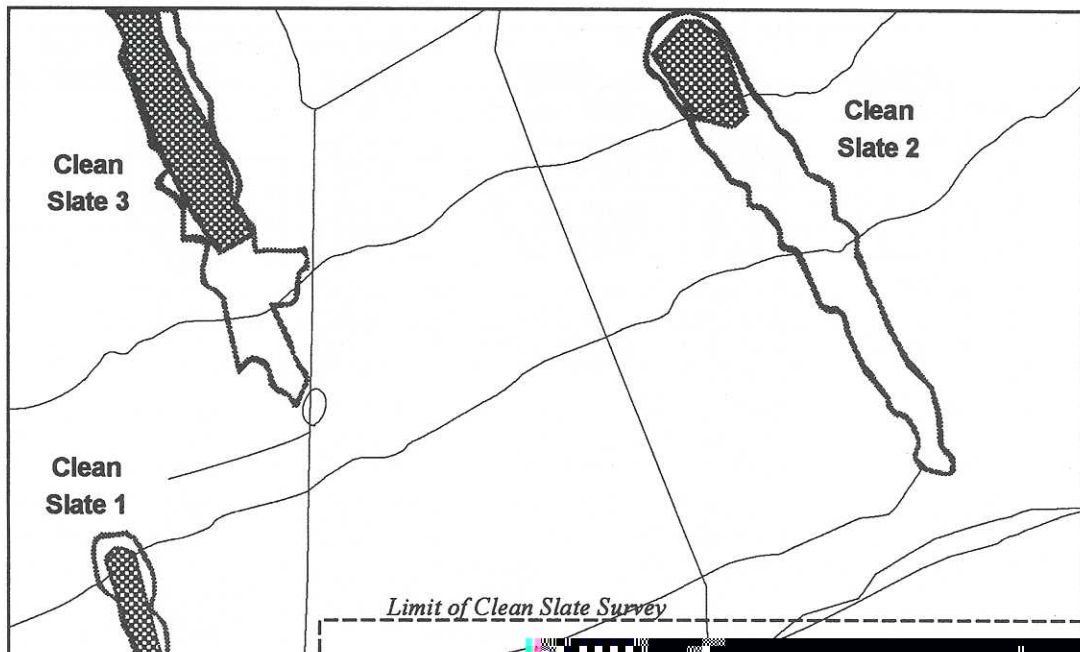


TABLE B-4. Radiological Results for Range Operations Center Soil Sampling Locations, 2001

Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
OC-02	Americium-241	pCi/g	-0.0234 ± 0.138	0.0349	0.255	U
	Cesium-137	pCi/g	0.198 ± 0.0672	0.0171	0.0414	
	Plutonium-238	pCi/g	0 ± 0.0951	0.00505	0.00722	U
	Plutonium-239/240	pCi/g	0.0307 ± 0.0157	0	0.0052	
	Uranium-235	pCi/g	0.138 ± 0.231	0.0718	0.244	U
	Uranium-238	pCi/g	2.28 ± 2.09	0.397	1.92	
	Uranium	mg/kg	0.883	0.0017	0.0393	
OC-03	Americium-241	pCi/g	-0.0192 ± 0.0891	0.0226	0.156	U
	Cesium-137	pCi/g	0 ± 0.0426	0.0135	0.0374	U
	Plutonium-238	pCi/g	0.00225 ± 0.0045	0.00463	0.00609	U
	Plutonium-239/240	pCi/g	0.00324 ± 0.00459	0	0.00439	U
	Uranium-235	pCi/g	0.0511 ± 0.11	0.0607	0.206	U
	Uranium-238	pCi/g	1.81 ± 1.4	0.266	1.25	
	Uranium	mg/kg	0.56	0.0017	0.0394	
OC-04	Americium-241	pCi/g	-0.0215 ± 0.0479	0.0164	0.0918	U
	Cesium-137	pCi/g	0.316 ± 0.0482	0.00992	0.0259	
	Plutonium-238	pCi/g	0.0823 ± 0.0338	0.00551	0.00858	
	Plutonium-239/240	pCi/g	0.0213 ± 0.0149	0.00303	0.0092	
	Uranium-235	pCi/g	0.164 ± 0.135	0.047	0.159	
	Uranium-238	pCi/g	1.69 ± 0.967	0.198	0.79	
	Uranium	mg/kg	0.573	0.0017	0.0394	
OC-10	Americium-241	pCi/g	0.0107 ± 0.0264	0.0125	0.0482	U
	Cesium-137	pCi/g	0.0275 ± 0.0266	0.0138	0.0369	U
	Plutonium-238	pCi/g	0.0203 ± 0.0137	0.00467	0.0061	
	Plutonium-239/240	pCi/g	0.00324 ± 0.00459	0	0.00439	U
	Uranium-235	pCi/g	0.211 ± 0.163	0.0554	0.191	
	Uranium-238	pCi/g	1.78 ± 0.641	0.162	0.469	
	Uranium	mg/kg	0.788	0.0017	0.0396	
OC-13	Americium-241	pCi/g	-0.0828 ± 0.0824	0.0209	0.14	U
	Cesium-137	pCi/g	0.0388 ± 0.03	0.0125	0.038	
	Plutonium-238	pCi/g	0.0179 ± 0.0105	0.00378	0.00404	
	Plutonium-239/240	pCi/g	0.00536 ± 0.00483	0	0.00291	
	Uranium-235	pCi/g	0.151 ± 0.16	0.0531	0.2	U
	Uranium-238	pCi/g	1.19 ± 1.22	0.247	1.17	
	Uranium	mg/kg	0.689	0.0017	0.0398	

See notes at end of table.

TABLE B-4. Radiological Results for Range Operations Center Soil Sampling Locations, 2001
(concluded)

Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
OC-19	Americium-241	pCi/g	-0.0546 ± 0.0916	0.0214	0.156	U
	Cesium-137	pCi/g	0.00904 ± 0.0218	0.0129	0.0352	U
	Plutonium-238	pCi/g	0.0063 ± 0.00634	0.0039	0.00427	
	Plutonium-239/240	pCi/g	0.0034 ± 0.00394	0	0.00307	
	Uranium-235	pCi/g	0.0737 ± 0.176	0.0549	0.221	U
	Uranium-238	pCi/g	1.7 ± 1.25	0.254	1.27	
	Uranium	mg/kg	0.786	0.0017	0.0392	
OC-22	Americium-241	pCi/g	-0.0755 ± 0.078	0.0241	0.144	U
	Cesium-137	pCi/g	0.0144 ± 0.0241	0.0146	0.0381	U
	Plutonium-238	pCi/g	0.0047 ± 0.00545	0.00384	0.00424	
	Plutonium-239/240	pCi/g	0.00113 ± 0.00391	0.00185	0.00491	U
	Uranium-235	pCi/g	0.157 ± 0.161	0.0617	0.203	U
	Uranium-238	pCi/g	0.801 ± 1.14	0.285	1.23	U
	Uranium	mg/kg	0.717	0.0017	0.0392	
OC-23	Americium-241	pCi/g	0.0613 ± 0.128	0.0249	0.209	U
	Cesium-137	pCi/g	0.103 ± 0.0463	0.0135	0.044	
	Plutonium-238	pCi/g	0.0476 ± 0.0197	0.00499	0.00767	
	Plutonium-239/240	pCi/g	0.00887 ± 0.00677	0	0.00343	
	Uranium-235	pCi/g	0.176 ± 0.202	0.0572	0.246	U
	Uranium-238	pCi/g	0.612 ± 1.52	0.292	1.65	U
	Uranium	mg/kg	0.577	0.0017	0.04	

NOTES: pCi/g = picocurie per gram

mg/kg = milligram per kilogram

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.

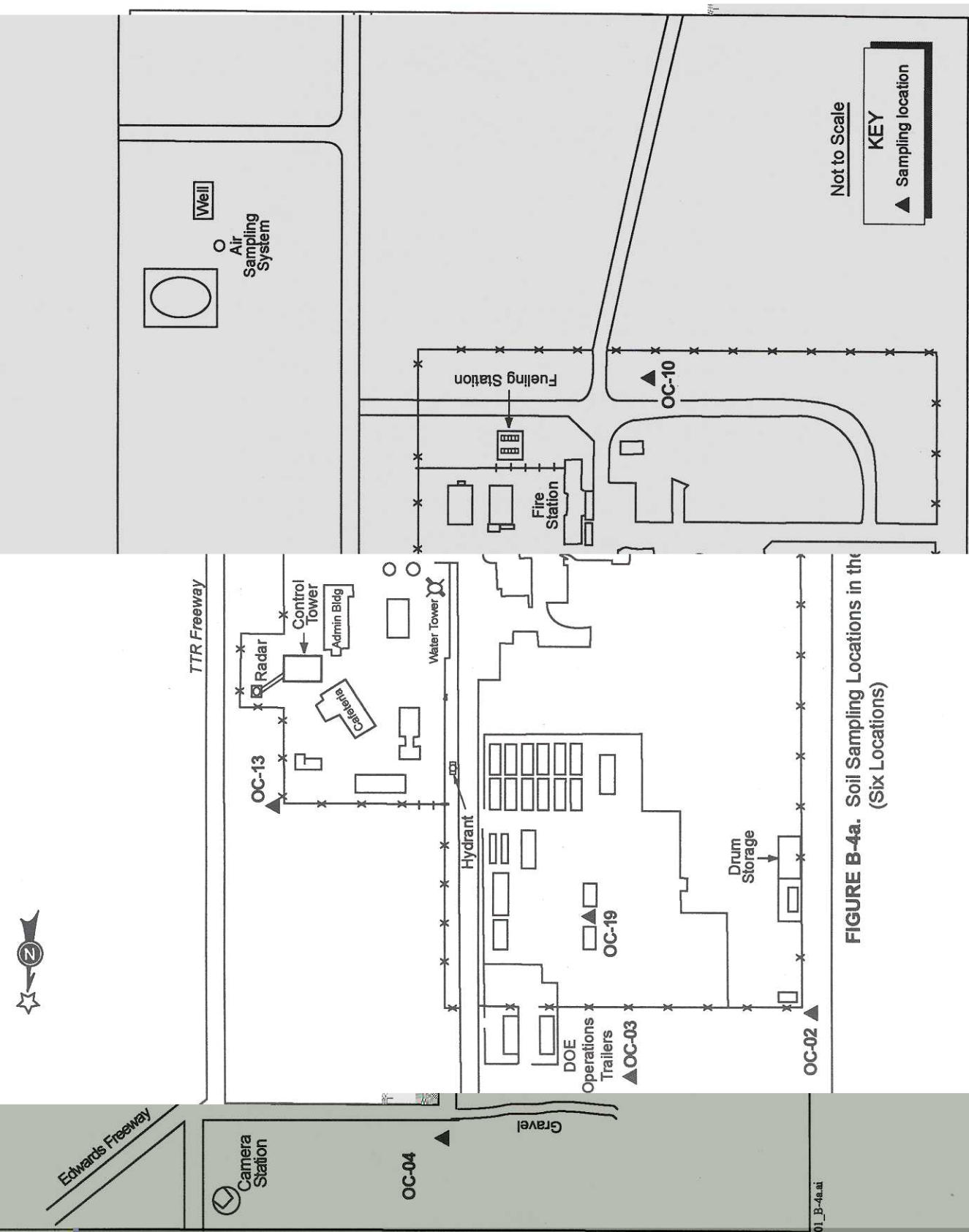
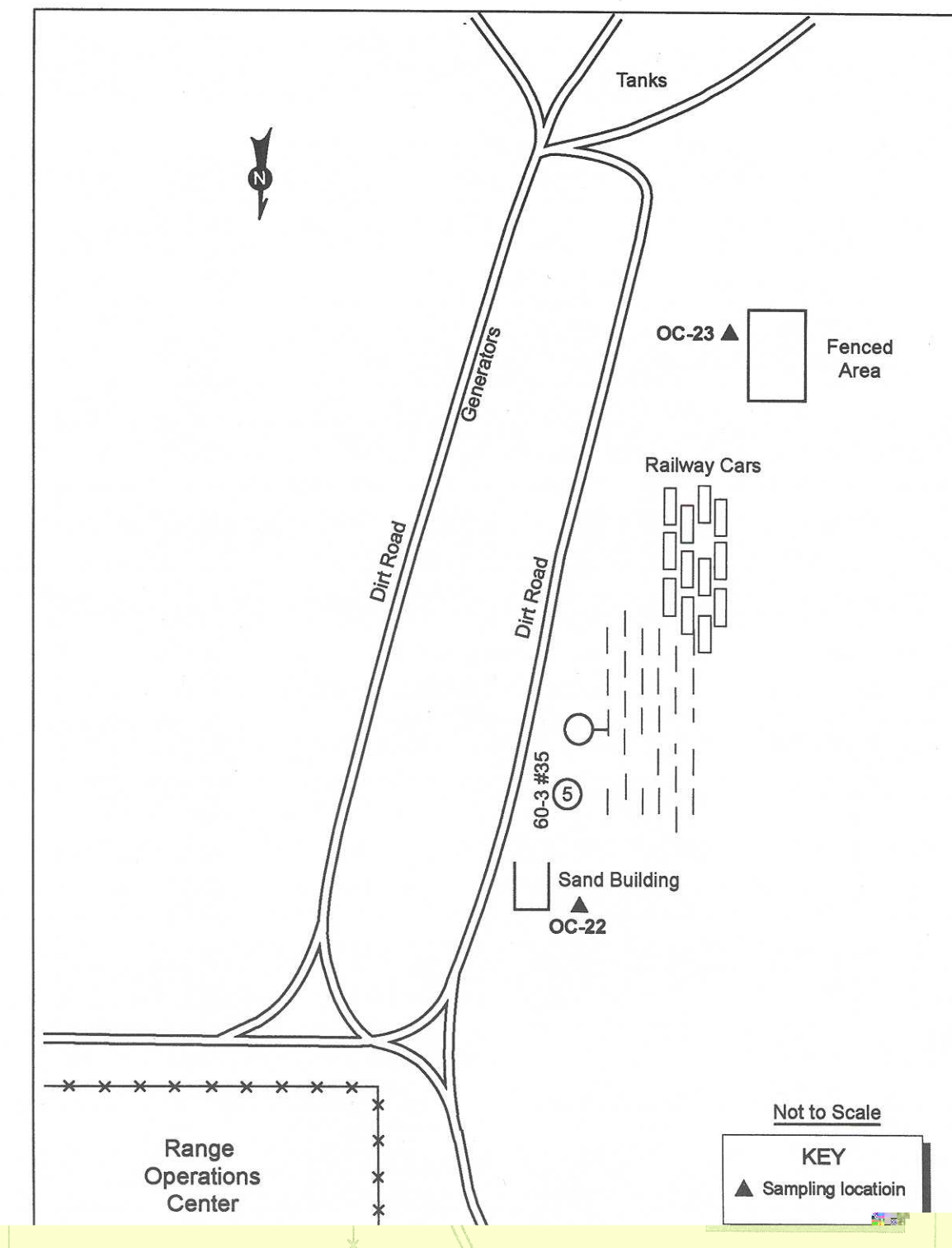


FIGURE B-4a. Soil Sampling Locations in the
(Six Locations)

Range Operations Center and Compound

01_B-4a.ai



01_B-4b.ai

FIGURE B-4b. Soil Sampling Locations Around the Range Operations Center Storage Yard (Two Locations)

TABLE B-5. Radiological Results for Various On-site Soil Sampling Locations, 2001

Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
D-01	Americium-241	pCi/g	0.546 ± 0.0832	0.0139	0.0663	
	Cesium-137	pCi/g	0.107 ± 0.0406	0.00803	0.0443	
	Plutonium-238	pCi/g	0.0228 ± 0.0123	0.00982	0.00699	
	Plutonium-239/240	pCi/g	2.77 ± 0.304	0.00709	0.00497	
	Uranium-235	pCi/g	0.0391 ± 0.238	0.0484	0.22	U
	Uranium-238	pCi/g	2.46 ± 0.78	0.189	0.623	

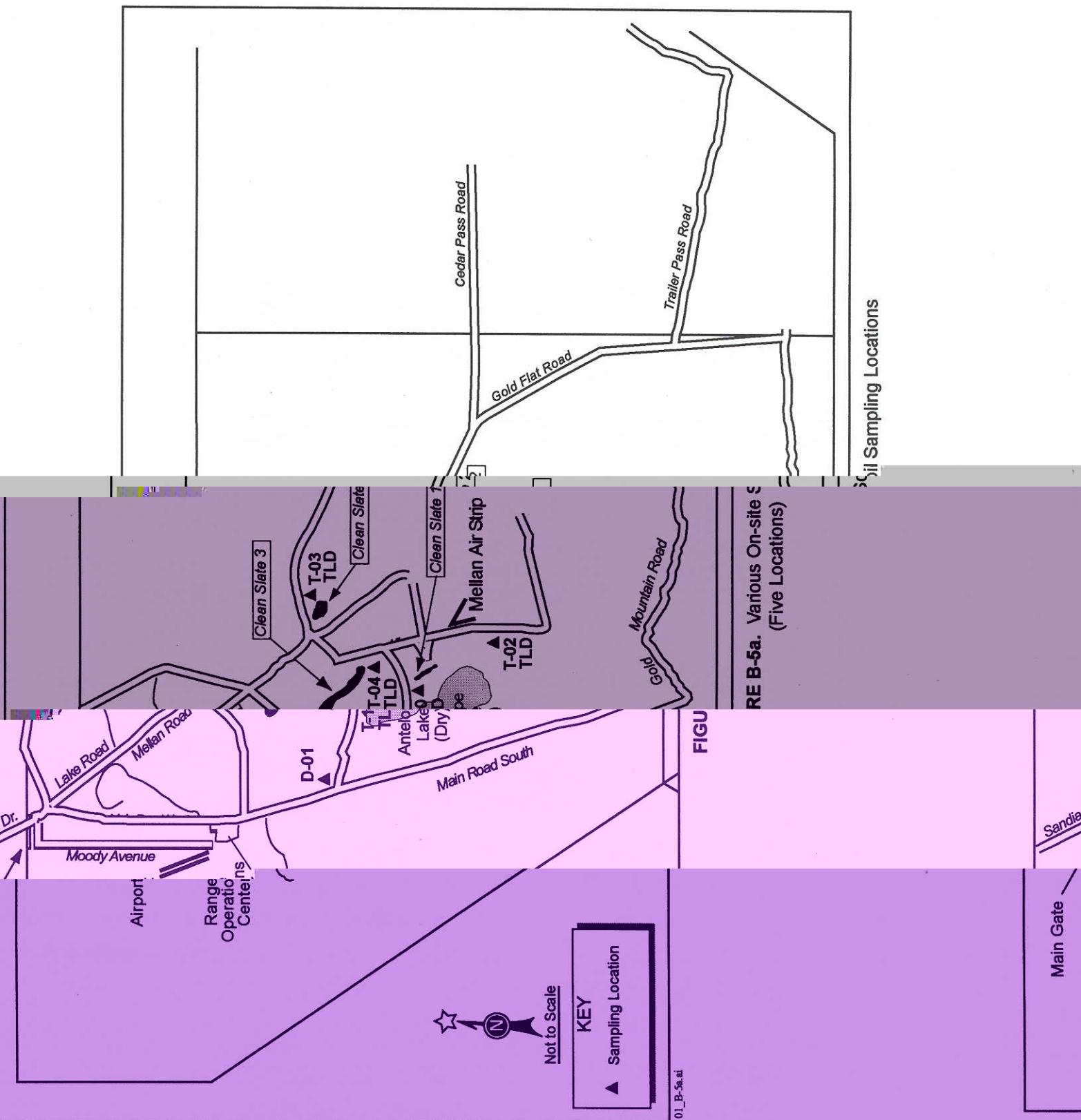
TABLE B-5. Radiological Results for Various On-site Soil Sampling Locations, 2001 (*concluded*)

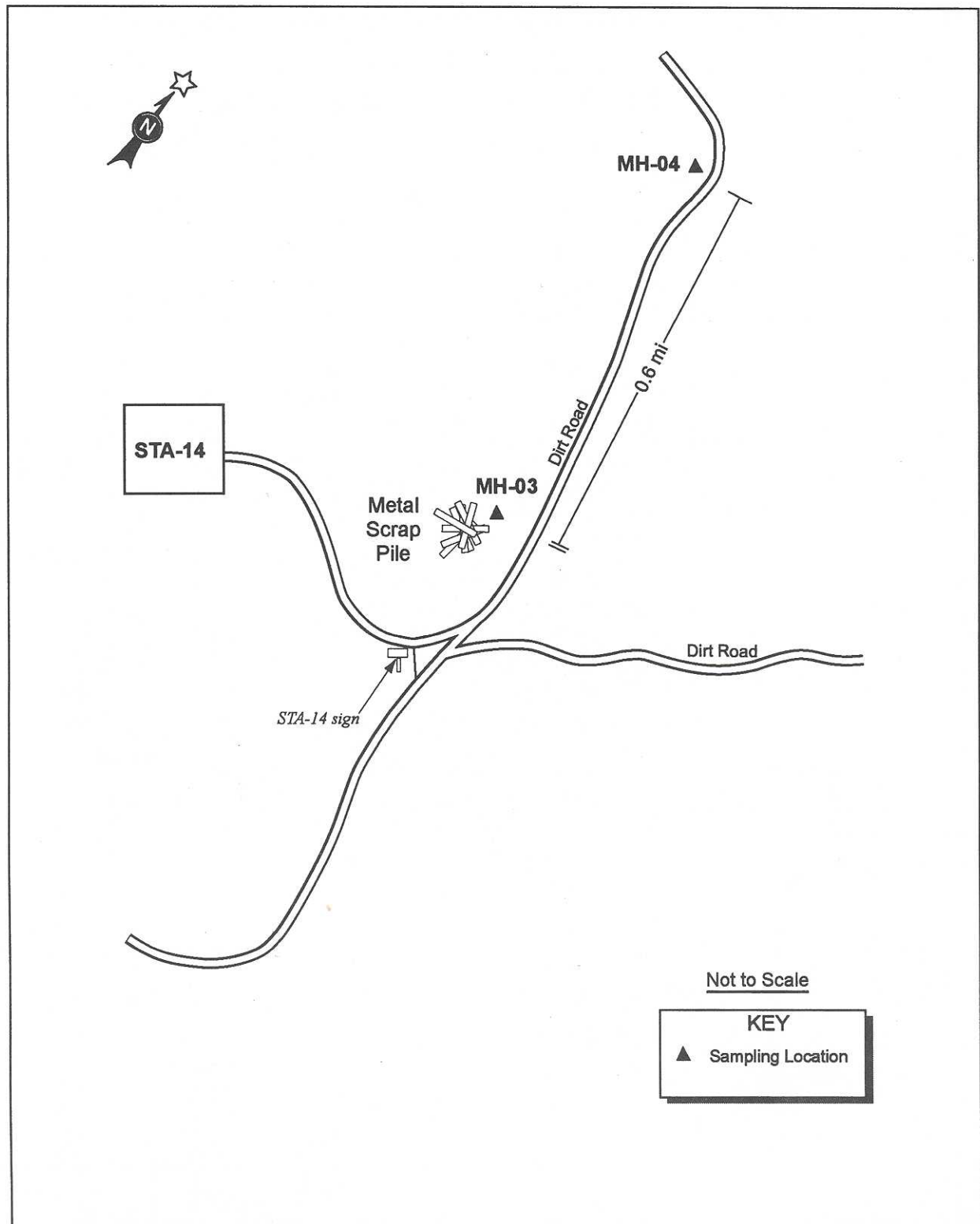
Location	Analyte	Units	Activity	Decision Level	Detection Limit	Lab Qualifier
T-04	Americium-241	pCi/g	0.0923 ± 0.0928	0.0175	0.136	U
	Cesium-137	pCi/g	0.442 ± 0.062	0.006	0.0344	
	Plutonium-238	pCi/g	-0.000934 ± 0.00674	0.00946	0.0066	U
	Plutonium-239/240	pCi/g	0.122 ± 0.0252	0.00701	0.00518	
	Uranium-235	pCi/g	0.146 ± 0.171	0.0372	0.191	U
	Uranium-238	pCi/g	1.78 ± 1.17	0.221	1.09	
	Uranium	mg/kg	0.744 ± -999	0.0017	0.0395	
T-10	Americium-241	pCi/g	0.0398 ± 0.0566	0.0157	0.0889	U
	Cesium-137	pCi/g	0.217 ± 0.0821	0.00944	0.051	
	Plutonium-238	pCi/g	-0.0102 ± 0.00818	0.0103	0.00845	U
	Plutonium-239/240	pCi/g	0.0818 ± 0.0194	0.00644	0.00252	
	Uranium-235	pCi/g	0.107 ± 0.209	0.0544	0.275	U
	Uranium-238	pCi/g	1.61 ± 1.19	0.212	0.86	
	Uranium	mg/kg	0.745 ± -999	0.0017	0.0393	
T-20	Americium-241	pCi/g	0.0306 ± 0.0894	0.0238	0.174	U
	Cesium-137	pCi/g	0.175 ± 0.0527	0.0144	0.0431	
	Plutonium-238	pCi/g	0.0302 ± 0.0273	0.0078	0.0164	
	Plutonium-239/240	pCi/g	0.143 ± 0.0535	0	0.0118	
	Uranium-235	pCi/g	0.156 ± 0.137	0.0657	0.249	U
	Uranium-238	pCi/g	1.64 ± 1.52	0.283	1.43	
	Uranium	mg/kg	0.58 ± -999	0.0017	0.0392	

NOTES: pCi/g = picocurie per gram

mg/kg = milligram per kilogram

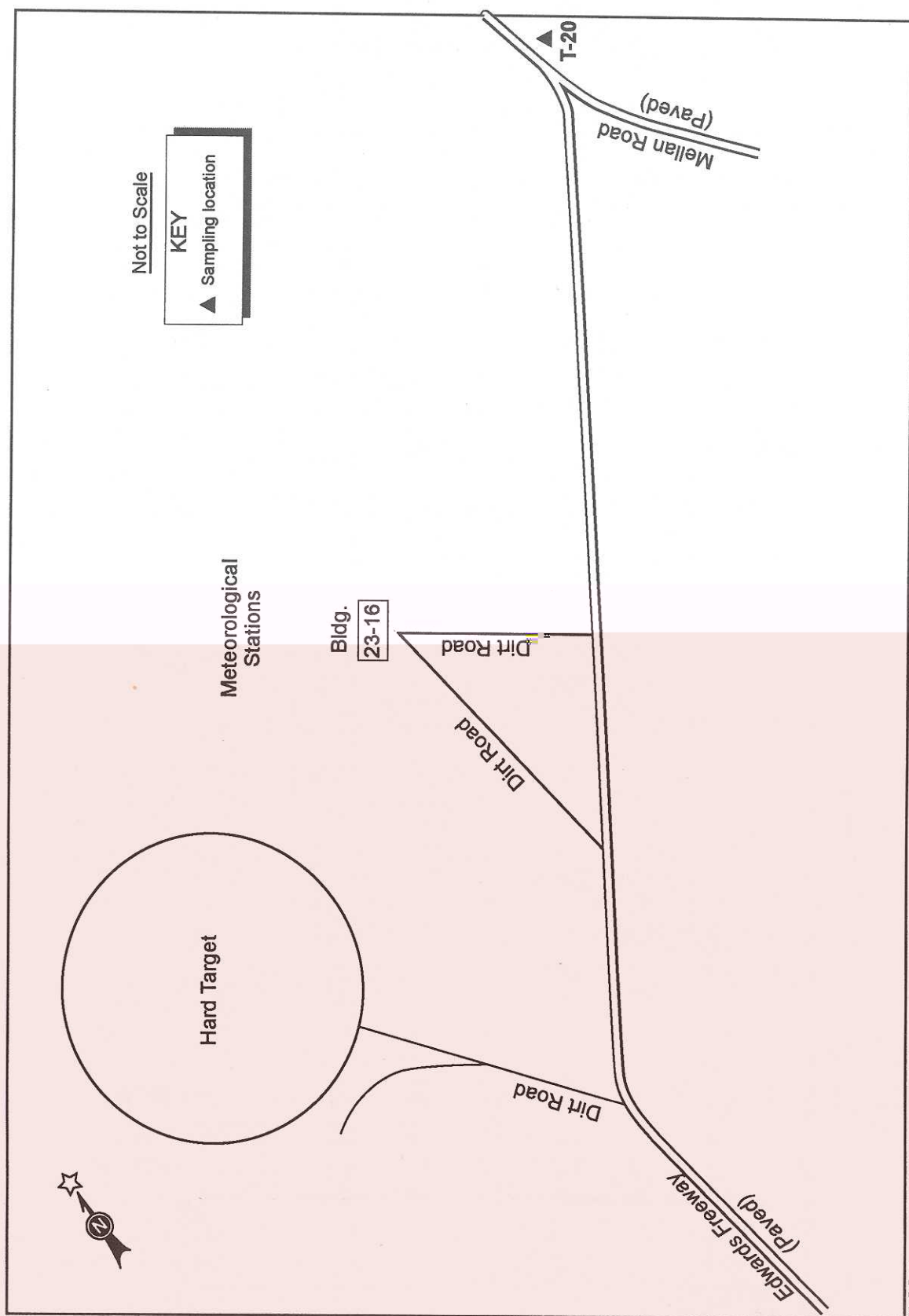
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.





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FIGURE B-5b. Various Soil Sampling Locations at Mellan Hill Area
(Two Locations)



01_B-5c.ai

FIGURE B-5c. Various Soil Sampling Locations Near the Hard Target/Depleted Uranium Area (Two Locations)

TABLE B-6. Radiological Replicate Sampling for Soil Sampling Locations, 2001

Location Type	Location	Analyte	Units	Sample ID	Activity	Decision Level	Detection Limit	Lab Qualifier	Average	Std Dev	Min	Max	CV%
Various On-site	D-01	Americium-241	pCi/g	055242-001	0.546 ± 0.0832	0.0139	0.0663		0.469	0.211	0.231	0.631	44.90%
				055242-002	0.631 ± 0.361	0.0336	0.259						
				055242-003	0.231 ± 0.115	0.0172	0.11						
		Cesium-137	pCi/g	055242-001	0.107 ± 0.0406	0.00803	0.0443		0.0950	0.0114	0.0843	0.107	12.02%
				055242-002	0.0843 ± 0.0393	0.00798	0.0367						
				055242-003	0.0936 ± 0.0272	0.00592	0.0262						
		Plutonium-238	pCi/g	055242-001	0.0228 ± 0.0123	0.00982	0.00699		0.0268	0.0055	0.0228	0.033	20.42%
				055242-002	0.0245 ± 0.0122	0.00957	0.00666						
				055242-003	0.033 ± 0.0139	0.00959	0.00705						
		Plutonium-239/240	pCi/g	055242-001	2.77 ± 0.304	0.00709	0.00497		2.99	0.61	2.51	3.68	20.57%
				055242-002	2.51 ± 0.276	0.00834	0.00769						
				055242-003	3.68 ± 0.393	0.0067	0.00448						
		Uranium-235	pCi/g	055242-001	0.0391 ± 0.238	0.0484	0.22	U	0.067	0.032	0.0391	0.102	48.33%
				055242-002	0.0587 ± 0.119	0.0517	0.227	U					
				055242-003	0.102 ± 0.161	0.041	0.184	U					
		Uranium-238	pCi/g	055242-001	2.46 ± 0.78	0.189	0.623	U	1.69	0.77	0.927	2.46	45.38%
				055242-002	1.68 ± 2.06	0.388	1.93						
				055242-003	0.927 ± 0.859	0.219	0.899						
		Uranium	mg/kg	055242-001	0.59	0.0017	0.04		0.559	0.055	0.496	0.591	9.76%
				055242-002	0.591	0.0017	0.0394						
				055242-003	0.496	0.0017	0.0394						

See notes at end of table.

TABLE B-6. Radiological Replicate Sampling for Soil Sampling Locations, 2001 (*continued*)

Location Type	Location	Analyte	Units	Sample ID	Activity	Decision Level	Detection Limit	Lab Qualifier	Average	Std Dev	Min	Max	CV%
Various On-site	T-03	Americium-241	pCi/g	055245-001	0.133 ± 0.112	0.018	0.138	U	0.141	0.031	0.115	0.175	21.84%
				055245-002	0.175 ± 0.0508	0.0123	0.0621						
				055245-003	0.115 ± 0.0925	0.0151	0.0978						
		Cesium-137	pCi/g	055245-001	0.428 ± 0.0652	0.00615	0.0331		0.425	0.034	0.39	0.458	8.01%
				055245-002	0.39 ± 0.07	0.00708	0.0406						
				055245-003	0.458 ± 0.0645	0.00516	0.0272						
		Plutonium-238	pCi/g	055245-001	-0.00814 ± 0.0182	0.0143	0.0139	U	-0.00450	0.00414	- 0.00814	-4.7E-09	-91.95%
				055245-002	-0.00536 ± 0.0257	0.0185	0.0189	U					
				055245-003	-4.65E-9 ± 0.0224	0.0163	0.0163	U					
		Plutonium-239/240	pCi/g	055245-001	0.903 ± 0.112	0.00757	0.0061		0.706	0.171	0.603	0.903	24.17%
				055245-002	0.603 ± 0.0861	0.00819	0.00582						
				055245-003	0.612 ± 0.0853	0.00894	0.0082						
		Uranium-235	pCi/g	055245-001	0.204 ± 0.179	0.0384	0.2	U	0.156	0.042	0.132	0.204	26.65%
				055245-002	0.132 ± 0.203	0.0427	0.218						
				055245-003	0.132 ± 0.172	0.0358	0.176						
		Uranium-238	pCi/g	055245-001	2.34 ± 1.14	0.225	1.09		2.26	0.16	2.07	2.36	7.18%
				055245-002	2.36 ± 0.878	0.167	0.588						
				055245-003	2.07 ± 0.953	0.192	0.804						
		Uranium	mg/kg	055245-001	0.669	0.0017	0.0397		0.655	0.027	0.624	0.671	4.06%
				055245-002	0.671	0.0017	0.0394						
				055245-003	0.624	0.0017	0.0398						

See notes at end of table.

TABLE B-6. Radiological Replicate Sampling for Soil Sampling Locations, 2001 (*concluded*)

Location Type	Location	Analyte	Units	Sample ID	Activity	Decision Level	Detection Limit	Lab Qualifier	Average	Std Dev	Min	Max	CV%
South Plume Area	T-14	Americium-241	pCi/g	055251-001	0.15 ± 0.109	0.0155	0.0852		0.079	0.075	-0.00011	0.15	95.25%
				055251-002	0.0876 ± 0.0969	0.0245	0.176	U					
				055251-003	-0.000106 ± 0.147	0.0285	0.244	U					
		Cesium-137	pCi/g	055251-001	0.551 ± 0.109	0.0128	0.0545		0.549	0.022	0.526	0.569	3.94%
				055251-002	0.526 ± 0.0766	0.0113	0.0356						
				055251-003	0.569 ± 0.0802	0.011	0.0408						
		Plutonium-238	pCi/g	055251-001	0.00629 ± 0.00596	0.00172	0.00456		0.0064	0.0013	0.0051	0.00769	20.38%
				055251-002	0.0051 ± 0.00459	0	0.00276						
				055251-003	0.00769 ± 0.00664	0.00181	0.00478						
		Plutonium-239/240	pCi/g	055251-001	0.069 ± 0.0185	0.00266	0.00284		0.127	0.091	0.069	0.232	71.58%
				055251-002	0.0804 ± 0.0201	0.00313	0.00443						
				055251-003	0.232 ± 0.0405	0.00414	0.00609						
		Uranium-235	pCi/g	055251-001	0.102 ± 0.151	0.0618	0.278	U	0.098	0.018	0.0778	0.114	18.83%
				055251-002	0.114 ± 0.204	0.061	0.222	U					
				055251-003	0.0778 ± 0.139	0.0611	0.233	U					
		Uranium-238	pCi/g	055251-001	2.29 ± 1.12	0.183	0.797		1.31	1.01	0.27	2.29	77.03%
				055251-002	0.27 ± 1.47	0.264	1.37	U					
				055251-003	1.38 ± 1.77	0.299	1.86	U					
		Uranium	mg/kg	055251-001	0.556	0.0017	0.0396		0.551	0.014	0.536	0.562	2.47%
				055251-002	0.536	0.0017	0.04						
				055251-003	0.562	0.0017	0.0397						

NOTES: pCi/g = picocurie per gram
mg/kg = milligram per kilogram

Std Dev = Standard deviation

CV = Coefficient of variation

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level.

For radiochemical analytes the result is less than the decision level.

TABLE B-7. Non-radiological Results for Soil Sampling Locations in Area 9, 2001

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
A9-01	Aluminum	mg/kg	5590	1.07	4.81	
	Antimony	mg/kg	0.237	0.237	0.962	U
	Arsenic	mg/kg	2.88	0.137	0.481	
	Barium	mg/kg	71.4	0.0148	0.481	
	Beryllium	mg/kg	0.289	0.00767	0.481	J
	Cadmium	mg/kg	0.174	0.013	0.481	J
	Calcium	mg/kg	4570	1.94	9.62	B
	Chromium	mg/kg	3.15	0.218	0.481	
	Cobalt	mg/kg	1.5	0.0545	0.481	
	Copper	mg/kg	3.81	0.0251	0.481	
	Iron	mg/kg	5200	1.96	4.81	
	Lead	mg/kg	9.69	0.17	0.481	
	Magnesium	mg/kg	2250	0.308	1.92	
	Manganese	mg/kg	147	0.0239	0.962	
	Mercury	mg/kg	0.00455	0.00455	0.00897	HU
	Nickel	mg/kg	2.4	0.0995	0.481	
	Potassium	mg/kg	2870	0.866	48.1	
	Selenium	mg/kg	0.46	0.135	0.481	J
	Silver	mg/kg	0.0578	0.0578	0.481	U
	Sodium	mg/kg	245	1.25	9.62	
	Thallium	mg/kg	0.472	0.472	0.962	U
	Vanadium	mg/kg	9.94	0.0594	0.481	
	Zinc	mg/kg	16.6	0.13	0.481	
A9-02	Aluminum	mg/kg	6650	1.07	4.72	
	Antimony	mg/kg	0.237	0.237	0.943	U
	Arsenic	mg/kg	4.28	0.137	0.472	
	Barium	mg/kg	92.2	0.0148	0.472	
	Beryllium	mg/kg	0.406	0.00767	0.472	J
	Cadmium	mg/kg	0.302	0.013	0.472	J
	Calcium	mg/kg	7630	1.94	9.43	B
	Chromium	mg/kg	3.8	0.218	0.472	
	Cobalt	mg/kg	3.14	0.0545	0.472	
	Copper	mg/kg	4.81	0.0251	0.472	
	Iron	mg/kg	7760	1.96	4.72	
	Lead	mg/kg	17	0.17	0.472	
	Magnesium	mg/kg	2590	0.308	1.89	
	Manganese	mg/kg	182	0.0239	0.943	
	Mercury	mg/kg	0.00455	0.00455	0.00878	HU
	Nickel	mg/kg	3.01	0.0995	0.472	
	Potassium	mg/kg	3310	0.866	47.2	
	Selenium	mg/kg	0.582	0.135	0.472	
	Silver	mg/kg	0.0578	0.0578	0.472	U
	Sodium	mg/kg	284	1.25	9.43	
	Thallium	mg/kg	0.472	0.472	0.943	U
	Vanadium	mg/kg	13.3	0.0594	0.472	
	Zinc	mg/kg	22.5	0.13	0.472	

See notes at end of table.

TABLE B-7. Non-radiological Results for Soil Sampling Locations in Area 9, 2001
(concluded)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
A9-03	Aluminum	mg/kg	7800	1.07	5	
	Antimony	mg/kg	0.237	0.237	1	U
	Arsenic	mg/kg	4	0.137	0.5	
	Barium	mg/kg	114	0.0148	0.5	
	Beryllium	mg/kg	0.682	0.00767	0.5	
	Cadmium	mg/kg	0.0848	0.013	0.5	J
	Calcium	mg/kg	8020	1.94	10	B
	Chromium	mg/kg	4.03	0.218	0.5	
	Cobalt	mg/kg	8.78	0.0545	0.5	
	Copper	mg/kg	6.52	0.0251	0.5	
	Iron	mg/kg	8900	1.96	5	
	Lead	mg/kg	5.71	0.17	0.5	
	Magnesium	mg/kg	2960	0.308	2	
	Manganese	mg/kg	411	0.0239	1	
	Mercury	mg/kg	0.00455	0.00455	0.00987	HU
	Nickel	mg/kg	4.96	0.0995	0.5	
	Potassium	mg/kg	2900	0.866	50	
	Selenium	mg/kg	0.858	0.135	0.5	
	Silver	mg/kg	0.0578	0.0578	0.5	U
	Sodium	mg/kg	314	1.25	10	
	Thallium	mg/kg	0.472	0.472	1	U
	Vanadium	mg/kg	15.2	0.0594	0.5	
	Zinc	mg/kg	43.6	0.13	0.5	

NOTES: mg/kg = milligram per kilogram

B = The analyte was found in the blank above the effective decision level (organics), or the effective detection limit (inorganics).

H = Holding time exceeded.

J = Estimated value, the analyte concentration fell above the effective decision level and below the effective detection limit.

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision Level. For radiochemical analytes the result is less than the decision level.

TABLE B-8. Summary TLD Results for Calendar Year 2001, Tonopah Test Range

Location Class	Units	No. of Locations	Total Exposure	Std Dev.	Minimum	Maximum	# Days
Off-site*	mR	4	123.32	14.25	105.1	138.2	366
Perimeter	mR	4	141.22	4.54	134.50	144.40	366
On-site	mR	13	143.88	10.79	132.60	164.80	366

NOTES: *Results for location T-20 were missing in the 4th Quarter and location deleted from yearly statistics.

mR = Milliroentgen

Std = standard deviation

TLD = thermoluminescent dosimeter

TABLE B-9. TLD Measurements by Quarter and Location Class for Calendar Year 2001

Location Class	Location Number	Units	1 st Quarter (73 Days)		2 nd Quarter (111 Days)		3 rd Quarter (89 Days)		4 th Quarter (93 Days)		Yearly (366 Days)	
			Exposure	Error	Exposure	Error	Exposure	Error	Exposure	Error	Exposure	Error
Community	T-18	mR	25.2	2.3	35.7	1.7	28.9	1.6	30.2	2.7	120	4.2
	T-19	mR	23.3	2.0	30.7	1.2	23.0	1.1	28.1	2.3	105.1	3.5
	T-20*	mR	31.0	1.8	34.8	1.0	25.4	0.7			91.2	2.2
	T-21	mR	30.5	2.5	41.8	2.0	30.3	1.9	36.6	1.9	138.2	4.2
	T-22	mR	27.8	1.8	39.8	1.0	28.5	0.8	33.9	2.3	130.0	3.2
Perimeter	T-06	mR	33.8	1.8	38.5	1.0	30.7	0.7	39.7	3.0	142.7	3.7
	T-08	mR	31.3	1.9	38.1	1.1	28.9	0.9	36.2	4.3	134.5	4.9
	T-11	mR	33.2	2.4	38.4	1.8	31.9	1.7	39.8	2.4	143.3	4.2
	T-12	mR	34.6	2.4	39.1	1.8	32.3	1.7	38.4	1.4	144.4	3.7
On-Site	T-01	mR	38.7	1.9	43.7	1.1	35.7	0.9	46.7	1.9	164.8	3.0
	T-02	mR	35.9	2.0	37.7	1.3	32.1	1.2	42.6	4.1	148.3	4.9
	T-03	mR	37.7	2.6	39.6	2.1	32.7	2.0	40.7	2.6	150.7	4.7
	T-04	mR	35.7	1.9	53.7	1.1	31.8	0.9	40.1	1.8	161.3	3.0
	T-05	mR	35.8	3.0	39.5	2.6	30.0	2.5	39.9	4.0	145.2	6.2
	T-07	mR	30.6	2.0	38.9	1.3	28.8	1.1	36.7	3.8	135.0	4.6
	T-09	mR	32.3	2.1	34.4	1.5	28.8	1.3	37.1	2.1	132.6	3.6
	T-10	mR	36.5	2.1	39.5	1.5	31.8	1.3	41.8	4.8	149.6	5.6
	T-13	mR	29.1	1.8	39.7	1.0	29.0	0.7	36.0	2.5	133.8	3.3
	T-14	mR	29.7	2.0	40.0	1.3	28.9	1.2	34.6	2.3	133.2	3.5
	T-15	mR	33.0	3.1	40.8	2.7	32.1	2.6	38.1	2.8	144.0	5.6
	T-16	mR	30.1	1.9	40.9	1.2	31.1	1.0	35.8	2.0	137.9	3.2
	T-17	mR	28.4	2.1	41.8	1.5	29.6	1.3	34.2	3.4	134.0	4.5

NOTES: *Results in the 4th Quarter were missing; TLD post missing and no TLD returned for analysis.

mR = Milliroentgen

TLD = thermoluminescent dosimeter

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